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CONTINENTAL MOTORS · The Power That Moves the Nation's Business · AMERICA'S STANDARD

The Double Continental Power

The power of Continental Motors is two-fold. From the very beginning, these motors have been noteworthy because of their efficiency. The power they developed was always adequate, and whether in pleasure car or motor truck, these motors have squarely met all demands made upon them.

Out of this physical power has arisen another force even more potent. It is the power of Continental reputation. Years of satisfaction on the part of the public has developed a strong demand for this motor in automobiles and trucks. Today dealers in Continental-equipped motor vehicles recognize a great force working constantly for their benefit—Continental sales-power.

CONTINENTAL MOTORS COMPANY

Offices: Detroit, Mich.
Factories: Detroit—Muskegon

Largest exclusive motor manufacturers in the world.

Continental Motors

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STRONGER THAN EVER

Over 95 per cent of the equipped automobiles going into use this coming year will carry the Stewart Speedometer. Be sure it is on your car.

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Stewart

Speedometer

The Automobile

VOL. XXXV NEW YORK—THURSDAY, NOVEMBER 16, 1916—CHICAGO No. 20

G. M. C. Earnings Break Record

Approximately $25,000,000 Cash on Hand—Buick Builds 400 Cars Daily

DETROIT, MICH., Nov. 15—October earnings of the General Motors Co. were the largest in its history, the treasurer reporting approximately $25,000,000 cash on hand. The Buick Motor Co., its largest subsidiary, is turning out 400 cars daily.

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Cole Price Raised $100

DETROIT, MICH., Nov. 13—The Cole Motor Car Co. will raise the price of its eight-cylinder car $100, to $1,685, on the touring and roadster models. This change will go into effect Jan. 1.

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Kissel To Raise Prices Dec. 1

HARTFORD, WIS., Nov. 13—The Kissel Motor Car Co., this city, will raise the prices of its Hundred Point Six models on Dec. 1.

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Leonard Leaves Perfection Spring

CLEVELAND, OHIO, Nov. 15—Z. B. Leonard has resigned as chief of the laboratory of the Perfection Spring Co.

—

Belden Overland Chief Engineer

TOLEDO, OHIO, Nov. 10—Edward H. Belden has been appointed chief engineer of the Willys-Overland Co. this city. For the past 2 years Mr. Belden has been consulting engineer of the Packard Motor Car Co., Detroit.

Mr. Belden, who was born in 1868 at Jackson, Mich., began his business career as mechanical engineer with the McCormick Harvester Co., later becoming electrical engineer of the Fort Wayne Electric Co. and subsequently holding the same position with the Westinghouse Electric & Mfg. Co. Mr. Belden has been designing automobiles since 1905. In 1913 he was president and engineer of the Belden Engineering Co. and in 1914 became connected with the Packard Motor Car Co. He built one of the first six-cylinder motors constructed in this country and has been a member of the Society of Automobile Engineers since 1913.

—

Smith Form-A-Truck Co. Sold

CHICAGO, ILL., Nov. 15—The Smith Form-A-Truck Co., this city, maker of a motor truck unit that can be attached to the chassis of a low-priced car, has been acquired by Michaelis & Co. and affiliated interests. It is stated that the demand for the product is ahead of the present output, which will be immediately increased and additional buildings will be at once arranged for. The total sales for this year will reach approximately $3,000,000 and the net earnings will amount to at least $1,000,000.

—

Steenstrup with General Motors Export

DETROIT, MICH., Nov. 14—Peter S. Steenstrup has joined the General Motors Export Co., succeeding O. G. Bennett, who has resigned to embark in a new venture for himself. Mr. Steenstrup was formerly the general foreign representative for the Hupp Motor Car Co. and spent the past 3 years abroad studying conditions in South America and in Europe.

—

Abbott to Build in Cleveland

CLEVELAND, OHIO, Nov. 9—The Abbott Corp. has applied for a building permit to construct a $110,000 plant at 1131 East 152d Street, covering a ground space of 110 by 681 ft.

10,000 Regals Planned for 1917

Co. to Concentrate on De Luxe Eight and J. Models—To Discontinue Others

DETROIT, MICH., Nov. 15—The Regal Motor Car Co. production department is planning on an output of 10,000 cars for the 1917 season. The company will concentrate on model J and the De Luxe eight-cylinder type, dropping all other models. Enlarging the 1917 output to 10,000 cars represents almost 100 per cent increase over the production for the 1916 manufacturing season.

—

Humphrey Now in Detroit

DETROIT, MICH., Nov. 14—S. H. Humphrey, who resigned as vice-president in charge of production with the Chalmers company to become the vice-president in charge of manufacturing for the Briscoe Motor Corp., has resigned the latter position and returned to Detroit to engage in business for himself.

—

Whitman National Production Engineer

DETROIT, MICH., Nov. 14—F. H. Whitman has been appointed production engineer for the National Motor Vehicle Co. at Indianapolis. Mr. Whitman was formerly connected with Dodge Bros.

—

International Truck Incorporated

ALBANY, N. Y., Nov. 9—The International Motor Truck Corp., as a result of the recent refinancing, has been formed and will carry on business with $7,372,790. The capital consists of 71,043 shares of $100 each and 53,638 shares of no par value. The directors are A. E. Moore, G. F. Jebbitt, T. S. Buckingham.

Cummins-Monitor Reorganized

Monitor Motor Car Co. Formed—$1,000,000 Capital Planned for Near Future

COLUMBUS, OHIO, Nov. 11—A complete reorganization of the Cummins-Monitor Co., this city, makers of Monitors has been effected by the incorporation of the Monitor Motor Car Co. with a preliminary capital of $10,000. This capital will be increased to $1,000,000 in the near future, a large part of which will be paid in. The concern has been assembling and manufacturing two models for the past year and these models will be continued with slight changes. They are the four-cylinder, priced at $795, and the six-cylinder, priced at $995.

Under the reorganization C. C. Cummins will be president, H. P. Jeffers, vice-president and F. S. Cummins, secretary and general manager. The plant is located at 402 Mount Vernon Avenue, where it will remain for the time being. It is the plan to manufacture several thousand cars during the coming season and to strengthen the sales organization by securing agents in all of the larger distributing centers.

The Monitor is the result of the work of the Cummins brothers, who were formerly agents in Columbus. They conceived the Monitor several years ago and have been manufacturing a number of the cars.

—

R. J. Firestone Now Vice-President

AKRON, OHIO, Nov. 9—At the annual meeting of the Firestone Tire & Rubber Co., Nov. 2 R. J. Firestone was elected vice-president. Mr. Firestone has been sales manager for a number of years.

A. G. Partridge, formerly assistant sales manager, was appointed to succeed Mr. Firestone as general sales manager.

F. C. Blanchard becomes manufacturers' sales manager in charge of the company's increasing business among automobile makers.

—

Braender, of Tire Co., Dies

RUTHERFORD, N. J., Nov. 9—Philip Braender, president of the Braender Rubber and Tire Co., this city, died on Nov. 4 at his home in White Plains in his 68th year.

Mr. Braender was born in Germany in 1849 and at the age of 16 came to America where he entered the real estate and building business in New York City.

In 1911 he entered the rubber business in conjunction with the late Frank McGowan under the style name of Cable Pneumatic Tire Co. and later in 1912 took over this interest under the present name and associated with him was the late G. Strauss, formerly with the Goodyear Rubber Co. in the bicycle tire time.

Mr. Braender was also president of the Braender Building & Construction Co. of New York, a member of the Arion Society of New York and Teutonia Lodge, No. 617, F. & A. M. He leaves a widow and four sons.

—

VerLinden Elected Olds President

LANSING, MICH., Nov. 13—E. VerLinden, general manager of the Olds Motor Works, has been elected president of that concern. Announcement of VerLinden's election came after a recent meeting of the board of directors of the Olds Motor Works.

VerLinden's early training in production methods was gained with the American Radiator Co. Before joining the Olds organization in 1912, he was a production expert for the Buick company as manager of Plant No. 1.

Prior to his connection with Buick, VerLinden was in business for himself, under the corporate title of the Michigan Auto Parts Co., which was bought by the General Motors Co. in 1909.

—

Laciar Is Kent General Sales Manager—Stock Being Underwritten

NEW YORK CITY, Nov. 13—R. J. Laciar has been appointed general sales manager of the recently formed Kent Motors Corp. Mr. Laciar made his entry into the automobile field in 1903, at which time he joined the late Capt. La Roche in the marketing of the Darracq car. Later he spent several years popularizing the two-cylinder Buick through the East. He has since been connected with W. E. Metzger in the sale of the E. M. F. car, with the Hupp company as Eastern district manager, and later with W. C. Durant in the Chevrolet organization.

The company, which will build a plant in Bellville, N. J., has a capital consisting of 200,000 shares of the par value of $10 each. Sixty per cent, or 120,000 shares, is held in the treasury. Against this will be issued negotiable trust certificates exchangeable in 3 years for stock.

The Security Transfer and Registrar Co., 66 Broadway, this city, has been designated as the depository and transfer agent of the company. The stock has been underwritten and is to be listed, it is stated, on the New York Curb market.

—

McCulla in Overland Engineering Dept.

DETROIT, Nov. 12—William R. McCulla has joined the engineering forces of the Willys-Overland Co. Mr. McCulla was formerly the aircraft motor engineer for the Packard Motor Car Co.

New Plant for Saxon Co.

To Build on 40-Acre Plot—First Unit of 500,000 Sq. Ft. Floorspace

DETROIT, MICH., Nov. 12—The Saxon Motor Car Corp. is commencing the erection of a new plant on 40 acres of land recently purchased by them. The first unit will be 240 by 1262 ft. and will have 500,000 sq. ft. of floorspace, and will house several departments so grouped that a car will move steadily forward from one end of the building to the other for assembly construction.

Progressive manufacturing and assembling will be employed in every department possible. Incoming material will be moved by traveling cranes and elevators to the stockrooms, and a system of conveyors is planned by which stock will be carried to the different manufacturing departments. The first unit will be completed May 1, and the remainder of the buildings June 1, 1917.

—

Empire Tire To Be Refinanced

TRENTON, N. J., Nov. 14—Increased business and expansion has forced one more company to join the long list of those to be refinanced this year. The Empire Rubber & Tire Co., this city, has about completed negotiations for reorganization and refinancing. The details of the plans of refinancing will be announced in the near future as soon as completed. At present the plans for the underwriting of the new stock are being worked out by Andrews & Co., New York. General C. E. Murray will continue as the active head of the company.

The Empire company was organized in 1913 with a capital stock of $500,000 common and $500,000 7 per cent cumulative preferred, with $500,000 common and $428,720 preferred outstanding.

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Hammers Is Hackett Consulting Engineer

DETROIT, MICH., Nov. 11—M. J. Hammers has been retained as consulting engineer for the Hackett Motor Car Co., and has been appointed as a non-resident director of the company.

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Lascaris Re-elected Salon Head

NEW YORK CITY, Nov. 13—At its recent meeting the Automobile Salon, Inc., which will conduct the Automobile Salon on Jan. 2 to 10 at the Astor, this city, re-elected Emanuel Lascaris president and T. E. Adams vice-president. Robert Schuette was elected secretary-treasurer, succeeding the late Stefan Kjeldsen, and J. R. Eustis was appointed manager of the salon.

N. A. C. C. Opposes Scare Ads.

Eighty Members Go on Record as Against It—Committee for Improvement

NEW YORK CITY, Nov. 13—With the object of eliminating what it terms "scare" advertising, eighty members of the National Automobile Chamber of Commerce at its last meeting recorded themselves as being opposed to advertising which can be classed under this head. This opposition is directed against not only concerns connected with the automobile industry, but against advertising in general which can be characterized under the scare heading.

Exactly what is meant by scare advertising might be made clear from the following extract bearing on the subject. "We may expect to see pictures of people dying in restaurants because they ate the wrong brand of bacon; of people mangled at the bottom of elevator shafts because they rode in an elevator using the wrong safety device; of children being rescued from fires because the wrong kind of window panes were used in the building; of passengers being carried under the ocean waves because they traveled on the wrong steamship line," etc., etc.

The N. A. C. C. has at present a committee working for a betterment of advertising along this line. This committee is expected to accomplish as much as possible by co-operation not only with vehicle makers, but also with those manufacturing parts and accessories. The question of scare advertising has already been taken up with certain companies, and it is expected that there will be an elimination of such as the result of this work.

The reason for the N. A. C. C. taking up this matter is that members of the chamber hold the view that scare copy is negative rather than affirmative in its effect, and that some more positive and constructive form of advertising could be used.

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A. O. Smith Corp. Incorporated

ALBANY, N. Y., Nov. 14—The A. O. Smith Corp., as a result of the recent refinancing, has been incorporated in this state with 130,000 shares, of which 100,000 shares are without par value. It will carry on business with $3,500,000. The directors are L. H. Gunther, S. B. Howard and A. W. Britton.

—

Dodge Suit Against Ford Postponed

DETROIT, Nov. 15—A continuance of 1 week, by consent of opposing counsel, was granted in the injunction proceedings started by Dodge Bros. to restrain Henry Ford from extending the Ford plant and to compel a further distribution of profits to Ford stockholders.

"The preliminary taking of evidence will not be finished in the coming week," said Attorney E. G. Stevenson for Dodge Bros., "but we expect it will have reached a point where we can come into court and agree upon the fixing of the day certain for the commencement of the trial."

The plaintiffs state that they expect to present evidence to show that the expansion planned by the Ford head jeopardizes the monetary interests of the minority stockholders.

$200,000,000 Offered

Henry Ford on the witness stand today admitted the offer of $200,000,000 was recently made to him for his 58 per cent of the shares of Ford stock. This offer he rejected and stated that his company made $3,600,000 in August and September, 1916, following the price decrease.

—

Lozier Bros. Co. Formed—$10,000,000 Capital

CLEVELAND, Nov. 14—Harry A. Lozier, former president of the Lozier Motor Car Co., and who recently retired as president of the H. A. Lozier Co., this city, has launched a new company, the Lozier Bros. Co., capitalized at $10,000,000. New York and Philadelphia capital is stated to be behind the company. Only 25 per cent of the capital is to be issued at present, the balance being reserved for subsequent disposal in expanding the business. The incorporators are F. R. Hansell of Philadelphia and G. H. B. Martin and S. C. Zymour of Camden, N. J.

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S. R. B. Creditors Ask for Sale

PHILADELPHIA, PA., Nov. 9—A committee consisting of 95 per cent of the creditors of the Standard Roller Bearing Co., which went into the hands of a receiver in 1913, has asked the Federal Court for an order to sell the property to pay the creditors. The sale has been objected to by some stockholders, who maintain that only the disposal of merchandise is necessary to meet all claims. Judge Thompson has decided to permit counsel to get together and draw a decree providing for a sale that will satisfy all claims and submit it to the court for approval.

—

Burgess Resigns from Dorris

ST. LOUIS, MO., Nov. 9—W. L. Burgess, has resigned as sales manager of the Dorris Motor Car Co., St. Louis, and is now manager of sales of the Efficiency Oil Corp., St. Louis.

Bankers in Control of Hess-Bright

Vanderlip One of Group — Conrad Patent Control Remains with Hess-Bright

PHILADELPHIA, PA., Nov. 14—The Hess-Bright Mfg. Co., manufacturer of ball bearings in this city makes the following statement with regard to the purchase of controlling interests in its company by a group of financial men who also own a substantial interest in the S. K. F. Ball Bearing Co., Hartford, Conn. The company states that controlling interest in the shares of the Hess-Bright Mfg. Co. has been secured by a group of bankers including Frank A. Vanderlip, National City Bank, New York, and Phillip W. Henry, Thatcher M. Brown, and Franklyn B. Kirkbride, of New York, and Marcus Wallenberg of Stockholm, Sweden.

The Hess-Bright company and the S. K. F. company will be operated quite independently of each other. The manufacturing facilities of Hess-Bright will be increased materially. B. D. Gray, recently elected president, retains his former stock holdings and will continue to manage the business as president. F. E. Bright, one of the organizers of the company, has retired from active participation but remains as chairman of the board of directors. The remainder of the organization continues as heretofore, excepting the board of directors, which follows:

Chairman of board, F. E. Bright; President, B. D. Gray; Willard Parker Butler, New York; Arthur V. Morton, Philadelphia; Paul von Gontard, managing director of the Deutsche Waffen- und Munitions Fabriken, Berlin, Germany.

Last week THE AUTOMOBILE mentioned that control of the Conrad patent royalties would pass from the Hess-Bright Co. This is not the case, as complete control of the Conrad patents will continue with the Hess-Bright Mfg. Co. as heretofore.

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Edwards Joins Automatic Carbureter

CHICAGO, Nov. 14—F. E. Edwards of Chicago, one of the most widely known men in American motor-racing circles, has joined the Automatic Carbureter Co., Chicago, as efficiency engineer. His chief work at present will be the introduction of the new Church fuel feed. Edwards has been chairman of the technical committee of the American Automobile Assn. and its chief technical representative for a number of years, and has supervised the majority of the speed and economy tests during that time.

WintherMotorTruck Co. Formed

Capital to Be $330,000—Factory to Be Built at Kenosha in Spring

KENOSHA, WIS., Nov. 11—M. P. Winther, who has been prominent in the development of the Jeffery Quad and for many years was associated with the Thomas B. Jeffery Co., Kenosha, has organized the Winther Motor Truck Co., with an authorized capital stock of $330,000, and is making final arrangements for the construction and equipment of a large factory in this city. A tract of 4 acres just west of Kenosha was purchased yesterday, and it is hoped that by the middle of April work on buildings will have progressed sufficiently to make production possible. Further details concerning the personnel of the Winther organization, the extent of its shops, and the product, are not available at this time, but will be made public in due time.

—

Watts Joins Republic Rubber

YOUNGSTOWN, OHIO, Nov. 9—L. A. Watts has been appointed purchasing agent of the Republic Rubber Co., this city. Other changes include the addition of James Buckley, who succeeds Neal Mahan as general foreman of the pneumatic tire and tube departments. Harry Davenport will be succeeded as foreman of the truck tire department by Thomas Wilson.

—

Eaton Torbensen Axle Manager

CLEVELAND, Nov. 13—J. O. Eaton, treasurer of the Torbensen Axle Co., Cleveland, was elected general manager of the company at a directors' meeting held recently.

—

Dudley Federal Truck Advertising Mgr.

DETROIT, Nov. 12—L. B. Dudley has been made the advertising manager of the Federal Motor Truck Co. He succeeds G. W. Cushing, who recently resigned to join the advertising staff of the Hudson Motor Car Co. Mr. Dudley was formerly connected with the Campbell-Ewald Co., advertising agent.

—

New Acme Truck Worm Axle

DETROIT, MICH., Nov. 10—The Acme Motor Truck Co., this city, is now producing a worm-driven truck axle incorporating, as its principal feature, the M. & S. worm differential. Another feature of the axle is that the brakes, of special design, have a full contact for the entire circumference excepting the small space occupied by the actuating cams.

It is built in a size for 2½- or 3-ton trucks, the standard reduction for this size being 7¾ to 1. The axle is a one-piece steel casting, with the worm gear carried in a separate carrier secured by eight bolts and having the small worm housing and axle bowl cover integral with it. The axle is of the semi-floating type, running on ball bearings throughout. The worm is of the straight type.

—

Glide to Make Its Own Motors

PEORIA, ILL., Nov. 13—In line with the general policy of the Bartholomew Co., maker of the Glide car, to concentrate the manufacture of its entire car in its local plant, is the announcement of a large addition to its plant for the purpose of building its own engines. The company is at present using a stock motor.

—

National Carbon to Add

CLEVELAND, OHIO, Nov. 13—The National Carbon Co., this city, maker of batteries, will soon erect new factory buildings costing $1,000,000. The company has just bought a parcel of land across Berea Road from the present carbon plant. This 63 1-3-acre tract has a frontage of 3368 ft.

—

Cornell Is Cole Asst. Sales Mgr.

INDIANAPOLIS, IND., Nov. 11—F. A. Cornell, formerly in charge of Willys-Overland service department and since then in charge of the heater department of the Perfection Spring Co., has been made assistant sales manager of the Cole Motor Car Co., in charge of the service department.

—

Graves Joins Russel Axle

DETROIT, MICH., Nov. 11—H. S. Graves has been appointed sales engineer of the Russel Motor Axle Co., North Detroit, Mich. Mr. Graves was formerly connected with the General Motors Co. as engineer. He has been connected with the automobile industry for the past 11 years.

—

Baker Resigns from G. V.

BOSTON, MASS., Nov. 13—Day Baker has resigned from the electric vehicle business of the General Vehicle Co. in New England.

—

Wiltrout Joins Crow-Elkhart

ELKHART, IND., Nov. 13—R. S. Wiltrout has been made efficiency manager of the Crow-Elkhart Motor Co., Elkhart, Ind. He was formerly with the Stewart-Warner Speedometer Corp. and recently has been manager for the John W. Blackledge Mfg. Co.

Papers for S. A. E. Meeting

Aeroplane and Farm Tractor Engines Will Be Covered—Many Others Promised

NEW YORK CITY, Nov. 13—The technical papers to be presented at the 1-day professional session on Jan. 11 of the Winter Meeting of the Society of Automobile Engineers will be representative of the enlarged activities of the society. Some of the papers will relate to automobile engineering, but in addition subjects of interest to aeroplane, tractor and marine engineers will be presented. The papers committee, of which K. W. Zimmerschied is chairman, is making the arrangements.

Captain V. E. Clark, U. S. A., will present a paper an aeroplanes with special relation to engines. This paper will deal also with the experiences of the army aviators on the Mexican border and suggest improvements in construction. It is also hoped that a detailed description will be given of a foreign aeroplane engine, which has recently been produced commercially in this country. A well-known engineer will discuss the design of engines for farm tractors. A paper will probably be read on motor trucks, with reference particularly to the proposed military specifications now being considered by the truck standards division of the S. A. E. standards committee and a specially appointed board of the War Department.

Tentative plans have been made to have experts contribute papers on passenger car spring-suspension, electrical equipment of gasoline cars, high-speed automobile engines, dynamics of the automobile and crankshaft balancing. It will thus be seen that the papers are of sufficient variety to attract every member of the Society. The authors will give brief digests of their papers, thus allowing time for lengthy and adequate discussion of the more important ones.

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S. A. E. Dinner and Theater Party Tickets Scarce

NEW YORK CITY, Nov. 16—That the annual banquet of the Society of Automobile Engineers on Jan. 11 at the Hotel Biltmore will be a banner one in point of attendance is assured by the fact that to date 460 tickets have been sold. The capacity is 750.

Every seat, numbering 762 has been taken for the special performance of Ziegfeld's Midnight Follies, which comes as a climax to the dinner. The demand for these seats has been so large that thirty applications so far have been returned.

Toledo Plants Are Rushed

Factories Breaking All Production Records and Financial Outlook Is Promising

TOLEDO, OHIO, Nov. 13—Toledo automobile and parts makers are rushed to capacity. Each company is building or planning to care for increased demand. The chief difficulties of the plants are lack of skilled workmen and insufficient space. Everywhere the companies tell of remarkable prosperity and an extremely good financial future outlook.

The Electric Auto-Lite Co. has enjoyed a great expansion. The company employs 2200 people and occupies 422,000 sq. ft. of floorspace, and has four buildings in the plant, including a new one recently finished and utilized. One structure is used for heavy machine work and assembly, a second for stock rooms, receiving and shipping, mail order and repair work, and on one floor has 500 girls engaged in winding field coils and armatures. A third building is occupied as a factory for making lamps, horns and starting switches, and the fourth serves as the office, drafting and experimental structure. The new building is four-stories high and constructed entirely of steel, glass and brick.

The concern did $6,000,000 business in 1915 and to date has shipped $10,000,000 worth for 1916, manufacturing 1400 starters a day now as compared with 800 in the year preceding. Numerous mechanical improvements have been installed to increase facilities for production, and include electric ovens, cable conveyors, twenty automatic machines, automatic punch presses, milling machines and eighty Potter & Johnson machines.

Milburn's Big Increase

At the Milburn Wagon Works 900 men are employed, as compared to 600 men at the same time in 1915. The company is making 1500 cars this year as against 1000 in 1915. It has purchased the plant of the Toledo Bending Co. and converted it into plant No. 2 of the Milburn factories, adding 128,732 sq. ft. to the 514,931 sq. ft. already occupied. It is planned to use plant No. 1 for the manufacture of closed cars and bodies, and plant No. 2 for making custom-made bodies and to care for light delivery business.

The concern has recently developed the electric taxicab business and plans to engage in that particular branch of the industry with special effort. Body work has increased 100 per cent, and from present indications will grow an additional 100 per cent during the coming year.

The Ohio Electric Vehicle Co. states that October was one of the most successful months in the company's career. Business for the year has increased more than 100 per cent. The concern manufactured 650 cars to date in 1916, as compared with 300 cars in 1915, and have doubled the number of salesmen on the road, doubled their national advertising and increased the number of men employed by 40 per cent. At present they employ 250 men, but would take on 300 men if they could find the skilled aluminum workers they require. From present prospects they anticipate an increase of 1000 per cent in business for the coming year.

—

Haynes to Add 600,000 Sq. Ft.

KOKOMO, IND., Nov. 13—The board of directors of the Haynes Automobile Co. last week authorized A. G. Sieberling, general manager, to prepare plans for a new building and to buy machinery for a capacity of 100 cars daily. It was announced that contracts will be let for buildings which will have a capacity of three times the number of cars made at present. The new buildings will have about 600,000 sq. ft. of floor space, which will be added to 350,000 sq. ft. now in operation in the company's plant.

—

Standard Tractor to Move

ST. PAUL, Nov. 11—The Standard Tractor Co., St. Paul and Wilimar, Minn., will move to the old prison at Stillwater, Minn. The company has $500,000 capital. It makes tractor engine plows and other farm machinery.

—

Briscoe Plants for K. C. and S. F.

SAN FRANCISCO, CAL., Nov. 11—The Briscoe Motor Corp., Detroit, Mich., has completed plans to build an assembling plant in this city and Kansas City, Mo. The local plant will be capable of turning out from 10,000 to 20,000 cars a season. The Kansas City plant will cost $300,000.

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More Room for Mayo-Skinner

CHICAGO, Nov. 13—The Mayo-Skinner Mfg. Co. has moved into enlarged quarters at 2115 Elston avenue. The company will enlarge its line in the near future.

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S. G. V. Creditors to Meet

READING, PA., Nov. 11—The creditors of the S. G. V. Co. of Delaware, which formerly operated its automobile plant here, will meet in the near future to distribute $85,000 in the hands of a receiver.

To Build Monarch in Hyattsville

Carter Brothers Co. Secures Exclusive Rights To Build Eight and Twelve

HYATTSVILLE, MD., Nov. 13—Monarch cars will be manufactured in this city as soon as all the machinery and materials arrive here. The Carter Brothers Co., this city, has secured the exclusive rights of the Monarch Motor Car Co., Detroit, and will build both Monarch models, an eight and a twelve.

In addition to the above standard models a new design of light car will be added to be known as the Monarch Midget.

The business of the Monarch company will be continued under the Monarch Motor Car Co., a subsidiary organization of the Carter Brothers Co.

—

Holihan Completes New Plant

DETROIT, Nov. 12—The Holihan Mfg. Co. has just completed its new plant on the 3½ acres of land they recently purchased. The main building is 80 by 400 ft. of the latest construction and includes steel and glass windows and a monitor roof. In addition a steel storage structure 65 by 45 ft., and a shipping shed 65 by 45 ft. with floors raised to car level are in process of completion.

The company has made ample allowance for future expansion and the present plant will cover about 50,000 sq. ft. of floor space.

At a special meeting of the stockholders, the capital stock was increased to $135,000, and the board of directors was increased by the election of H. J. Moir of Donaldson & Moir, and S. E. Ferris of H. W. Noble & Co.

—

Palmer-Moore To Quadruple Capacity

SYRACUSE, N. Y., Nov. 13—The Palmer-Moore Co. has increased its capital stock from $200,000 to $300,000. The additional capital will be used to quadruple the output of the plant, bringing the production up to above 600 trucks during the next year.

—

Elgin Motor Corp. to Add

CHICAGO, ILL., Nov. 13—The Elgin Motor Car Corp., this city will erect several additions to its factory to take care of increased business. This increased space will enable the company to build from 20,000 to 25,000 cars after the original year's allotment of 7500 is completed. Another building is now in process of construction and will permit the building of thirty cars a day.

Build Ams-Sterling at Amston

C. M. Ams Becomes President —Headquarters in Bridgeport —Car Design Improved

NEW YORK CITY, Nov. 13—Headquarters of the Sterling Automobile Mfg. Co., Inc., have been moved from this city to Bridgeport, Conn., Charles M. Ams having become president of the concern. Ams-Sterling cars will be built in a factory at Amston, Conn., in one chassis on which will be mounted roadster, five-passenger touring car and ½-ton delivery bodies.

Car at National Shows

The Sterling company will exhibit a car and a chassis at the national shows. Present specifications, which may be slightly changed later, differ from last year's model in several particulars, the general tendency being toward larger and better dimensions and equipment. Wheelbase has been lengthened from 102 to 110 in. The engine will continue as a four-cylinder L-head type, but will be 3⅛ by 4½ instead of 2⅞ by 4 in. This power plant has a removable head and its power output is 28 hp. at 2200 r.p.m. High efficiency and economy are the aims of its designers. Oiling is combination pump and splash with sight feed on cowlboard. Cooling continues thermo-syphon with a honeycomb radiator with polished German silver shell. Timing gears are helical and valves are large diameter with moderate lift.

A Stromberg model M carbureter replaces the make used last year and ignition is now by Bosch high-tension magneto instead of optional. Bosch starting and lighting is used with Willard 12-volt battery.

Dry-Plate Clutch Used

A Borg & Beck dry-plate clutch replaces the cone type previously used. The three-speed-and-reverse selective gearbox is continued. A semi-floating rear axle supplants the three-quarter design, and semi-elliptic springs replace cantilevers. Hotchkiss drive is continued. Control is still left, steering being of the irreversible split nut type, a 17-in. corrugated walnut wheel being used. Gasoline tank is in the cowl with filler cap and gage in the cowlboard. Tires are 30 by 3½, the same as last year. Wheels are hickory with twelve spokes and fitted with demountable rims.

Equipment includes two-piece windshield, double-bulb headlamps, tail and dash lights, Warner speedometer driven from the propeller shaft, one-man Jiffy top and dust boot, tools, etc.

Bodies are low, rakish streamline types with comfortable seats and plenty of leg-room. They are upholstered in black and painted Sterling blue black. Although price has not yet been definitely determined, it will probably be between $700 and $725.

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Abbott Downing Trucks on Market

BOSTON, MASS., Nov. 11—The Abbott Downing Co., Concord, N. H., one of the pioneer wagon builders in this country, which recently entered the truck making field, has leased salesrooms in Boston at 84 Brookline Avenue, in charge of F. S. Davis. The company is making two trucks of 1 and 2-ton capacities that will sell at medium prices.

The company will give special attention to truck bodies because of its facilities at its big plant at Concord, N. H. It will continue in the wagon making business also. Until the building is fully completed on Brookline Avenue where its sales and service station will be conducted, Mr. Davis will make his headquarters at 394 Atlantic Avenue.

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Canadian Chevrolet Sells 8000 Cars

OSHAWA, ONT., Nov. 11—The Chevrolet Motor Co. of Canada with headquarters at Oshawa, Ont., which has been manufacturing cars for a year, has sold 8000 cars to Canadians and has under course of construction large extensions to its present plant. Three new buildings are in course of construction which will give a total extra floorspace of 277,075 sq. ft. Part of this extra space will be used for storage and part for service but the larger part utilized in increasing its manufacturing facilities.

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Wants to Represent Tire in S. A.

NEW YORK CITY, Nov. 13—Walter E. Haumann, manager in Buenos Aires for Prowodnik tires, made in Riga, Russia, is in this city looking for representation of some American tire in Argentina. Mr. Haumann was manager of the Prowodnik interests from the start of the Buenos Aires branch until it was closed due to war conditions a few months ago. Previous to his South American experience he spent 4 years in Portuguese East Africa in export and import work.

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Fisher Body Sales Record

DETROIT, Nov. 14—A new high record was established by the Fisher Body Corp. in October when the sales amounted to $1,470,000, compared with $773,000 in October, 1915, an increase of 90.12 per cent. For the 8 months ended Oct. 31 last the sales increased 79.74 per cent.

—

Chicago Warehouse for Marathon Tire

CUYAHOGA FALLS, Ohio, Nov. 13—The Marathon Tire & Rubber Co. will open a warehouse in Chicago at 1458 South Michigan Avenue. It will be under the management of H. F. Smith.

Pilot's One-Model Program

Touring Car and Roadster at $1150 Each—Production To Be Doubled

RICHMOND, IND., Nov. 13—The Pilot Motor Car Co. of this city will confine its 1917 manufacturing efforts to a single car model known as 6-45, which will list as a touring car and roadster at $1150. The two models 6-55 and 6-75, which the concern has been manufacturing, have been discontinued. Increased production is to be carried out on the one model, and factory additions are now nearly completed, which should double the production of last year. In addition to the 6-45 being produced as a five-passenger car with a double cowl, it will also be built as a four-passenger roadster type with divided front seats and access to the rear seat via the space between the front ones.

In this one chassis the motor is a six-cylinder block type, 3⅛ by 5 with valves on one side. The cylinders are cast integrally with the upper half of the crankcase and the camshaft, water pump, and magneto shaft are driven by helical gears. Delco ignition, lighting and starting is used with the Bendix drive for the starting system. Other equipment includes Stewart vacuum gasoline system and Gould battery. The clutch is a dry-plate type, and the gearset, a unit with the motor, is a three-speed design with nickel steel gears. The tubular propeller shaft carries two inclosed universal joints. The floating axle uses spiral bevel reduction. Steering is irreversible worm and sector type. Cantilever rear springs are used.

The equipment includes a motor-driven horn, Stewart speedometer, one-man top, single tire carrier, and demountable rims.

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Kerosene Motors Co. Formed

PEORIA, ILL., Nov. 9—The Kerosene Motors Co. with a capital of $100,000 has been formed in this city to manufacture kerosene motors and accessories. The organizers are George McFarland, president of the Peoria Tractor Co., E. M. Smith and F. H. Bush. The motor is similar to that used in the Peoria tractors. Manufacturing is expected to start in about 30 days, the company planning to make the entire new motor and its parts. The company recently made a test trip of 8000 miles.

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King Tire Opens New Plant

DETROIT, Nov. 12—The King Tubeless Tire Co. will open its new plant at Barberton, Ohio, this week.

Brunswick M. C. Co. Formed

To Assemble Car Selling at $1,950—Capitalized at $500,000

NEWARK, N. J., Nov. 13—The Brunswick Motor Car Co. has been formed with a capitalization of $500,000 to produce an assembled automobile selling at $1,950, f.o.b. Newark. A four-cylinder Wisconsin engine, 4¾ by 5½, with a Rayfield carbureter is used. Other features are: Fedders radiator, Bosch magneto, Westinghouse starting and lighting, Brown-Lipe gearset, Timken axles and Parish & Bingham frame. It also uses Gemmer steering gear, Stewart vacuum feed and Silvertown cord tires. Drive is Hotchkiss type.

The body is of a high quality job, all rear compartment woodwork being of mahogany, as is the instrument board. There are also five mahogany cabinets in the rear compartment, containing a set of Thermos bottles, sandwich tins, and room for other articles. Each cabinet has a Yale lock. Two Waltham clocks are furnished, one on the instrument board and one in front of the rear compartment.

Russel Smith is president of the company, Everett Cadmus is vice-president, J. T. Bunt is secretary, and A. V. Weeks is treasurer. The company is temporarily using a plant of 15,000 sq. ft. floorspace, but a new plant will later be established along the Pennsylvania Railroad tracks outside of Newark. From 500 to 1000 cars will be produced during the coming year.

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Aniser Becomes Mechanical Belt

ST. JOSEPH, MO., Nov. 13—The Aniser Mfg. Co. has changed its corporate name to Mechanical Belt Co. and is marketing Crowe fan belts exclusively. L. D. W. Van Vliet is president, other officers being, secretary and treasurer, H. D. Gilbert; sales manager, O. G. Young, Jr.; directors, J. D. Richardson, J. E. Dolman and the officers.

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Firestone Gives $1,000,000 for Welfare

AKRON, OHIO, Nov. 13—The Firestone Tire & Rubber Co., this city, has voted to give $1,000,000 for an employees' welfare and insurance fund. Two weeks ago the company opened its new club house, said to have cost over $300,000.

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$1,000,000 Plant for Victor

PHILADELPHIA, Nov. 14—The Victor Motor Co., this city, capitalized at $2,000,000, will build a $1,000,000 plant at Grubbs Landing, near Claymont, Del., for the manufacture of the Victor Four, a moderate-priced car. The company recently bought 12 acres of land there for building purposes. It has also leased a group of eight factory buildings at Jenkintown, and will commence operations there in a limited way. One thousand men will be given employment in the temporary plant. The employees in the whole plant will number 2000.

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Iowa Companies Merge

FORT MADISON, IOWA, Nov. 13—At a special meeting the stockholders of the Perfection Tire & Rubber Co., Fort Madison, Iowa, it was voted unanimously to consolidate the Perfection Tire & Rubber Co., the Perfection Tire & Rubber Co., Ltd., and the Champion Auto & Equipment Co. About 130 stockholders and officers were in attendance.

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Goldman to Build Trucks

CHICAGO, ILL., Nov. 13—Eugene Goldman, Chicago Republic truck dealer, is severing his connection with that company and has organized his own company to build trucks. Complete announcement and specifications will be given later.

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Pullmore Motor Truck Co. Formed

NEW CASTLE, OHIO, Nov. 2—The Pullmore Motor Truck Co. has been organized in this city with a capital of $600,000, the concern having purchased a site on the Gibson farm, along the Butler Avenue Road.

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Advertisement Errors

A typographical error appeared last week in the advertisement of the U. S. Ball Bearing Co. in THE AUTOMOBILE. The advertisement stated: "A leading manufacturer of worm gear units in England advised against the use of annular bearings to carry worm loads." This was in error. The copy should have read: "A leading manufacturer of worm gears in England advises against the use of roller bearings to carry worm loads and recommends the use of annular bearings to carry worm loads."

A clerical error in the advertisement of the Golden, Belknap & Swartz Co. appearing in THE AUTOMOBILE for Oct. 19 made it appear that the cylinders of the G. B. & S. engine have a bore of 3¾ in. and a stroke of 4¾ in. The dimensions should have been 3¾ in. bore and 4¼ in. stroke.

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Fisher Body Buys Regal Unit

DETROIT, MICH., Nov. 13—The impression given in a story last week that the whole plant of the Regal Motor Car Co. was sold to the Fisher Body Co. was due to an error, as the Regal company sold only one of its units to that company.

$2,000,000 Plant for Cadillac

Co. Plans To Increase Working Force from Present 8000 to 12,000

DETROIT, MICH., Nov. 14—The Cadillac Motor Car Co. has purchased a 40-acre site formerly owned by the American Car & Foundry Co. and will erect a new factory for the construction of Cadillac cars. The projected plant, upon completion, will entail an investment in buildings and machinery of approximately $2,000,000. The company plans to employ about 12,000 men in the new factory. At present the company has 8000 employees.

—

Goodyear to Make Own Fabric

HARTFORD, CONN., Nov. 11—The Goodyear Cotton Mills, of Killingly, Conn., has been incorporated with $5,000,000 capital, to engage in general textile manufacturing. The incorporators are Francis Seiberling, Fred Miller and Harold Hutchins. This concern is practically a subsidiary of the Goodyear Tire & Rubber Co., Akron, and will manufacture tire fabrics for that concern.

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Erickson Building Front-Drive Truck

WARREN, PA., Nov. 11—C. A. Erickson, formerly with the Scripps-Booth Co., Detroit, Mich., has arrived in this city and is perfecting two models of a front-drive delivery truck in the plant of the Jacobson Machine Mfg. Co. The light delivery truck which Mr. Erickson is bringing out will carry from 1000 to 1500 lb.

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Harroun to Complete Factory by Spring

DETROIT, MICH., Nov. 11—The Harroun Motor Corp. is hastening every detail in the endeavor to complete their new factory by the early spring of 1917, so that next May will witness the new structure, with 300,000 sq. ft. of floor space, complete and ready to produce 2000 motor cars a month.

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To Make Borland Wheel

ST. PAUL, Nov. 11—A company is to be incorporated to make the J. A. Borland wheel with solid rubber tire invented by Borland, recently of Cincinnati. Hadley Summers is to be president and E. C. Piersal, Dodge Center, Minn., is to be treasurer. R. M. Lampman is secretary and C. F. Updike vice-president under present plans.

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Youngstown Co. to Add

YOUNGSTOWN, OHIO, Nov. 9—Plant extensions that will involve an expenditure of about $4,000,000 will be made by the Youngstown Sheet & Tube Co., this city.

Grossman Reincorporates

Forms Corporation with $320,000 Capital All Paid in To Take Care of Expansion

NEW YORK CITY, Nov. 13—The Emil Grossman Mfg. Corp. with a capital of $320,000 has been formed as the result of a reorganization of the company, which is part of the management's plan for the enlargement of the business. The activities of the company will be concentrated on the production of Red Head spark plugs, Ever Good bumpers and Ever Good mirrors. The manufacturing facilities in the Bush Terminal No. 20, will be enlarged. The company has leased building No. 95, Bush Terminal, for the exclusive rust proofing process which will be applied to all metal goods. The producing capacity in the grinding, polishing, nickel-plating and black enameling departments will be trebled.

The capital stock is divided into $150,000 first preferred; $160,000 second preferred; and $10,000 shares of common stock of no par value. The entire capital has been paid in. The capital of the old company consisted of $250,000 common and $100,000 preferred. This was all bought back by Emil Grossman, president and general manager.

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O'Connor Back from Australia

DETROIT, MICH., Nov. 14—N. E. O'Connor of the service department of the Maxwell Motor Co. has returned to Detroit following a 3-months' trip in Australia and New Zealand.

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M. & A. M. Adds Six Members

NEW YORK CITY, Nov. 13—The Motor and Accessory Manufacturers has added six new concerns to membership, bringing the total membership of the association to 260. Those admitted are: Walker Mfg. Co., Racine, Wis., accessories; Becker Brothers, Chicago, Ill., brushes for starting motors, lighting generators and magnetos. Bay State Pump Co., Boston, Mass., engine driven tire pumps and piston packings. Universal Motor Products Co., Indianapolis, Ind., tops. Ericsson Mfg. Co., Buffalo, N. Y., ignition apparatus, Berling magnetos. Craftsman Motor Corp., Chicago, Ill., detachable wire wheels and heaters.

—

Dazey Joins Chalmers Co.

DETROIT, MICH., Nov. 14—Roy Dazey has joined the Chalmers Motor Co. to take charge of the department that publishes the various house organs. Mr. Dazey was formerly connected with the Packard Motor Car Co. in the sales department.

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Wilson Tire Reorganization Planned

SPRINGFIELD, ILL., Nov. 10—A reorganization of the Wilson Tire and Rubber Co., this city, is now in process. W. W. Gardner, treasurer of the company, has resigned and it is stated that E. W. Wilson, president and chief promoter of the company, will be succeeded by a new president at the next meeting of the board of directors.

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Increased Capitals

NEW YORK CITY, Nov. 10—Brewster & Co., Long Island City, has increased its capital from $2,000,000 to $2,500,000 to provide funds for the manufacture of a chassis for its automobiles, formerly imported from England and France.

SPRINGFIELD, OHIO, Nov. 11—The Kelly-Springfield Motor Truck Co.; increase of capital from $3,014,000 to $6,000,000.

CLEVELAND, OHIO, Nov. 11—The Hall Motor Car Co.; increase of capital from $1,000,000 to $2,000,000.

DAYTON, OHIO, Nov. 13—The Acme Carbureter & Mfg. Co.; increase of capital from $10,000 to $15,000.

Daily Market Reports for the Past Week

Material	Mon.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.65	.65	.65	.65	.65	.65	...
Antimony, lb.	.13	.13	.13	.13	.13	.13	...
Beams and Channels, 100 lb	2.96	2.96	2.96	2.96	2.96	2.96	...
Bessemer Steel, ton	50.00	50.00	50.00	50.00	50.00	50.00	...
Copper, Elec., lb	.30	.30	.30	.30	.33	.33	+ .03
Copper, Lake, lb	.30	.30	.30	.30	.33	.33	+ .03
Cottonseed Oil, bbl.	12.09	12.39	12.45	12.70	12.60	12.67	+ .58
Fish Oil, Menhaden, Brown, gal	.60	.60	.60	.62	.62	.62	+ .02
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal	1.25	1.25	1.25	1.40	1.40	1.30	+ .05
Lead, 100 lb.	7.02½	7.02½	7.02½	7.02½	7.02½	7.02½	...
Linseed Oil, gal.	.90	.90	.93	.96	.96	.96	+ .06
Open-Hearth Steel, ton	50.00	50.00	50.00	50.00	50.00	50.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.82	.82	.82	.82	.82	.82	...
Rubber, Ceylon, First Latex, lb.	.66	.68	.68	.67½	.67	.66	...
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	42.37½	42.85	43.00	43.37½	43.37½	43.87½	+1.50
Tire Scrap, lb.	.06⅜	.06⅜	.06⅜	.06⅜	.06⅜	.06⅜	...

Copper at 33 Cents Per Lb.

Highest It Has Been Since 1864—Steel Expected To Go Up

NEW YORK CITY, Nov. 13—Copper featured this week's market activities with a rise of 3 cents a lb. to 33 cents. Tin rose $1.50 per 100 lb. to $43.87½. Fish oil rose 2 cents a gal. and lard oil 5 cents a gal. Linseed oil rose 6 cents a gal. to 96.

The enormous demand for copper is not yet satisfied and sellers predict 35 cents a lb. A glance over the price range since 1860 shows the high range that copper has reached. In 1860 this metal sold high at 24 cents a lb., and in 1864 reached 55 cents, the highest that has ever been paid for it. In 1894 it dropped as low as 9 cents a lb., the lowest price ever paid. Last year this time it sold as low as 13 cents and as high as 24 cents.

Though no increase took place this week in the steel market there is an upward tendency seen in quotations. The greatest activity since the present movement in the steel trade started is now here. Prices are showing increasing signs of moving toward even higher levels, despite the sharp advances already made. Foreign countries are inquiring for the metal, and domestic consumers also are taking whatever quantities the manufacturers are willing to book.

The market for crude rubber, particularly fine Para, is firm. Owing to an unusual drouth in the upper Amazon districts it has been impossible to get the crop down to Para and Manaos in normal amounts. Quotations are now 82 cents a lb. as against 73 a month ago.

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Leak-Proof Business

ST. LOUIS, MO., Nov. 13—L. A. Safford, vice-president of the McQuay-Norris Mfg. Co., maker of Leak-Proof piston rings, says that business reports made at the meeting of the company's salesmen last week indicate a greatly increased business for the coming year. The reports, especially from Texas and the South, were the best ever received and indicated that the jobbers in that territory were set for their greatest year's business in 1917.

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Longuet Buys Accessories for S. A.

NEW YORK CITY, Nov. 8—C. Longuet of the firm of Longuet & Co., Buenos Aires, Argentina, is spending some time in U. S. A. making purchases of automobile accessory lines for Argentina.

Mr. Longuet is making a rather complete study of various accessories that should be suitable for his field. He is taking the careful course of submitting samples to his firm before placing orders. In this way he is making certain that the lines of accessories are suitable. Two years ago Mr. Longuet spent some months in this country making purchases of automobile accessories and hardware merchandise.

—

Offer to Standard Welding Shareholders

CLEVELAND, Nov. 12—Shareholders of the Standard Welding Co. have received an offer from Borton & Borton, investment bankers, to purchase the property of the company at a price that will net them between $244 and $245 a share. The assent of 90 per cent of the total outstanding stock is necessary to transact the deal.

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Dividends Declared

Maxwell Motor Co.; quarterly of 2½ per cent on common, payable Jan. 2 to stock of record Dec. 11.

Texas Co., regular quarterly 2½ per cent, payable Jan. 1.

Pratt & Whitney Co.; quarterly of 1½ per cent on preferred, payable Nov. 15.

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Holmes Resigns from Michigan Welding

DETROIT, MICH., Nov. 15—A. L. Holmes has resigned from the sales department of the Michigan Electric Welding Co., effective Dec. 1.

Big Drop in Car Securities

General Motors Leads with 300 Point Loss—Maxwell, Chevrolet and Overland Drop

NEW YORK CITY, Nov. 13—Liquidation of automobile issues had the usual effect upon prices. Drops of from a fraction to 300 occurred. The recession, however, has not been taken seriously by automobile shareholders. October and November are generally poor months for automobile shares. With the approach of the automobile show, it is stated, motor shares will get stronger.

The most pronounced declines were shown in Chevrolet, Maxwell, Studebaker, Willys-Overland, and General Motors. The latter company featured the recession with a drop of 300 points from 810 to 510. Notwithstanding the depressing conditions of the market, there were several outstanding gains made by several of the stocks. Ajax Rubber, in face of the usual declines, has made an advance of 8⅝ points in 14 days. The company's stock within the last 2 weeks has sold as high as 77. White stock has also shown strength.

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M. & A. M. Show Week Schedule

NEW YORK CITY, Nov. 13—The Motor and Accessory Manufacturers announces the following events scheduled for show week, Jan. 7, as follows: Wednesday, Jan. 10, executive committee, banquet committee, finance committee, and board of directors' meetings at association's offices; thirteenth annual meeting at Waldorf Astoria at 3 o'clock, followed by the ninth annual banquet at Waldorf at 7.30 p. m.; Thursday, board of directors meeting at association's offices.

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Pierce-Arrow Assets $13,776,911

NEW YORK CITY, Nov. 11—The total net assets of the Pierce-Arrow Motor Car Co., which were taken over by the Pierce-Arrow Motor Car Corp., Buffalo, last week, were on Oct. 1 valued at $13,776,911. It is estimated that by Dec. 31, 1916, this value will have increased $1,000,000. For the 7 months ended July 31 last net profits before depreciation were $1,660,000 for August $540,000; September, $560,000, making a total of $2,760,000 for the 9 months, which after depreciation show a net profit of $2,460,000.

—

White Stock on 8 Per Cent Basis

CLEVELAND, OHIO, Nov. 11—The White Motor Co. has declared a quarterly dividend of 2 per cent, $1 a share, placing the stock on an 8 per cent per annum basis. The stock has been on a 7 per cent per annum basis. The dividend is payable Dec. 31 to holders of record Dec. 15. The par value of the shares is $50.

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co	73½	74½	+3½
J. I. Case T. M. Co. pfd	87	90	+4
Chalmers Motor Co. com	130	140	+5
Chalmers Motor Co. pfd	112	115	+7
*Chandler Motor Car Co	103	103½	—2
Chevrolet Motor Co	173	177	—13
Enger Motor Car Co	7¾	8	..
Fisher Body Corp	38	40	—1
Fisk Rubber Co. com	80	95	..
Fisk Rubber Co. 1st pfd	109	114	..
Fisk Rubber Co. 2d pfd	95	105	..
Firestone Tire & Rubber Co. com	1350	1400	+200
Firestone Tire & Rubber Co. pfd	106½	108	+2½
*General Motors Co. com	510	870	—300
*General Motors Co. pfd	122	124	—2
*B. F. Goodrich Co. com	68¾	69	+3⅝
*B. F. Goodrich Co. pfd	113	114⅜	—1
Goodyear Tire & Rubber Co. com	294	297	+1
Goodyear Tire & Rubber Co. pfd	108¾	109½	..
Grant Motor Car Corp	7	9	—1
Hupp Motor Car Corp. com	4½	5½	—¾
Hupp Motor Car Corp. pfd	85	95	—7
International Motor Co. com	5	6½	—1
International Motor Co. pfd	22	27	—2
*Kelly-Springfield Tire Co. com	74¾	75½	—2¾
*Kelly-Springfield Tire Co. 1st pfd	96	100	—1
Kelsey Wheel Co	55	56	..
*Lee Rubber & Tire Corp	39½	39⅝	—2
Keystone Tire & Rubber Co	15	16	..
*Maxwell Motor Co. com	71¾	72¼	—12¾
*Maxwell Motor Co. 1st pfd	82	82½	—3
*Maxwell Motor Co. 2d pfd	49½	50	—4½
Miller Rubber Co. com	242	250	+2
Miller Ruber Co. pfd	105½	106½	+ ½
Mitchell Motor Co	58	60	..
National Auto Corp	40	41½	..
Packard Motor Car Co. com	..	170	..
Packard Motor Car Co. pfd	94	99	+1
Paige-Detroit Motor Car Co	37	38	—1
Peerless Truck & Motor Corp	22½	24	— ½
Pierce-Arrow Motor Car Corp	55⅜	56¼	..
Portage Rubber Co. com	165	169	—5
Portage Rubber Co. pfd	..	..	..
Regal Motor Car Co. pfd	20	30	..
Reo Motor Car Co	46¼	47	+ ¼
Saxon Motor Car Corp	76⅜	78	— ⅜
A. O. Smith Co. com	43	43¾	..
A. O. Smith Co. pfd	96½	96¾	..
Springfield Body Corp. com	93	96	—2
Springfield Body Corp. pfd	125	135	+5
Spicer Mfg. Co	46¾	47	..
Standard Motor Construction Co	7	8	..
Stewart Warner Speed. Corp. com	109	112	—1½
Stewart Warner Speed. Corp. pfd	..	..	..
*Studebaker Corp. com	123½	124	—5
*Studebaker Corp. pfd	112¼	115	..
Stutz Motor	64⅝	65¼	..
Swinehart Tire & Rubber Co	88	91	—2
United Motors Corp	61⅝	62	—2⅞
*U. S. Rubber Co. com	59⅝	60	—1⅛
*U. S. Rubber Co. pfd	111	111½	—1
White Motor Co	55	55¼	— ¼
*Willys-Overland Co. com	37	37¼	—5½
*Willys-Overland Co. pfd	100	101	—3

*At close Nov. 13, 1916. Listed New York Stock Exchange.
Quotations by John Burnham & Co.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co	42	44¾	— ½
Chalmers Motor Co. com	126	..	+2
Chalmers Motor Co. pfd	109	..	..
Continental Motor Co. com	37¾	38½	+ ¼
Continental Motor Co. pfd	9½	10¼	..
Ford Motor Co. of Canada	293	300	..
General Motors Co. com	..	825	..
General Motors Co. pfd	..	126	..
Maxwell Motor Co. com	74	76½	—9½
Maxwell Motor Co. 1st pfd	82	84½	—2
Maxwell Motor Co. 2d pfd	50	52½	—2½
Packard Motor Car Co. com	160	168	..
Packard Motor Car Co. pfd	100	102	..
Paige-Detroit Motor Car Co	37	..	—1
W. K. Prudden Co	..	50	..
Reo Motor Car Co	46¼	47	+ ¾
Studebaker Corp. com	123	126	—3½
Studebaker Corp. pfd	109	..	..
C. M. Hall Lamp Co	..	31	..

INACTIVE STOCKS

Atlas Drop Forge Co	..	33	..
Kelsey Wheel Co	55	60	..
Regal Motor Car Co. pfd	20	..	..

Traffic Laws to Be Clear

To Affect All Vehicles and Will Be Uniform in All States —Registration Included

WASHINGTON, D. C., Nov. 18—Simplification is to be the keynote of the new uniform motor vehicle and traffic law which will be promulgated in a short time by the legislative board of the A. A. A. The motor vehicle laws now on the statute books of most of the States are unnecessarily long and cumbersome. Duplication and further confusion exists where a State has separate motor vehicle and traffic laws on its books.

"Highway traffic in its final analysis is but a single problem," says Chairman O. I. Yellott, "whether it relates to motor cars, horse-drawn vehicles, traction engines, or pedestrians. Traffic should be handled as one problem by one general set of laws, so that the rules governing one particular kind of traffic may fit into and be consistent with those governing all other kinds of traffic.

"The details of the uniform law to be framed by the A. A. A. board have not yet been fully worked out, but it may be stated in a general way that the first sub-division will deal with general provisions relating to the applicability of the law and definitions of terms used therein. The second sub-division will deal with the appointment, powers, and duties of a State traffic commissioner, who will have general supervision of traffic of all kinds on the public highways. The third sub-division will deal with the registration of motor vehicles and operators. The fourth will deal with the operation of vehicles of all kinds on the public highways, as well as with the conduct of pedestrians thereon. The fifth will deal with the enforcement of the preceding provisions.

"Thus each sub-division of the proposed law will be almost wholly self-contained, thereby doing away with a great deal of the confusion which now exists in so many State laws by reason of different kinds of provisions being intermingled. But the idea of simplification will be carried still further. The provisions relating to the traffic commissioner will be made quite brief and very simple. One section will define his duties; another, his powers; both in like general terms. Broad provisions will be used to extend these duties and powers as far as may be necessary to accomplish the general objects of his appointment. The courts, as a rule, may safely be trusted to amplify provisions of this kind with much more satisfactory results than where the law-maker himself attempts to enumerate all such duties and powers in great detail."

—

Earle & Boggs Enlarge Accounts

NEW YORK, Nov. 14—Earle & Boggs, this city, manufacturers' representatives, will add to its account the Buda Co., Harvey, Ill., and the Fuller & Sons Mfg. Co., Kalamazoo, Mich., its territory covering the States east of the western boundary of Pennsylvania. They also handle the accounts of the Blood Bros. Machine Co., Allegan, Mich., and the Pierce Governor Co., Anderson, Ind.

—

Fosdick Plans Automotive Company

BOSTON, MASS., Nov. 11—The Harry Fosdick, Inc. was formed here to-day. While its primary object is to deal in Pathfinder cars for New England, its main object is to go into everything possible along the lines of automotive power. Mr. Fosdick has been working on the plans for the past 6 months. The charter grants the right to sell, manufacture, buy and deal in all automotive powers, including automobiles, aeroplanes, marine, railroad or anything else that moves with a motor. The company has a capital of $20,000, and has leased temporary salesrooms here.

Mr. Fosdick's idea is to begin operations to meet the future which he realizes will mean the adoption of motors more generally for aeroplanes, submarines, vessels of all kinds, and even for railroads. William Hilliard, who was formerly with him, and who spent much time with the Burgess Aeroplane Co., learning to handle aircraft, has joined him. Mr. Hilliard, who was also with the Pathfinder, is known as the winner of the Climb to the Clouds, and for winning the light car race at Savannah with a Lancia.

—

C. & C. Co. To Handle R. I. V. Ball Bearings

NEW YORK, Nov. 13—The C. & C. Sales Corp. has been formed by I. R. Caplan, formerly connected with the R. I. V. Co. and Belmont Corp., formerly purchasing agent for Fiat, Poughkeepsie, N. Y. The company will deal in various types of anti-friction bearings, having taken over the R. I. V. Co.'s entire stock, for which it will be retail sales agent.

—

Fulton Takes C. & E. Products

MILWAUKEE, Nov. 13—The Fulton Co. has taken over the entire output of the C. & E. Mfg. Co., Marshalltown, Ia., the principal products of which are cutouts, Ford wheel pullers, accelerators for Fords, pedals, fender braces and camshaft bearings for Fords. These will be distributed to the jobbing trade in the United States and Canada.

—

New 3500-Mile Alliance Tire

ALLIANCE, OHIO, Nov. 13—The Alliance Tire & Rubber Co., the corporation which has succeeded The Alliance Rubber Co., Alliance, Ohio, announces a 3500-mile tire for 1917, a product that will be marketed at a low figure to the retail trade.

—

Peter A. Frasse & Co. 100 Years Old

NEW YORK CITY, Nov. 13—"One Century in Business" is the title of a booklet just issued by Peter A. Frasse & Co., this city, Philadelphia, Buffalo and Hartford, commemorating the opening of its first store in this country. This company is one of the large dealers in steel tube and tool steel, also mechanics' tools and machinery supplies.

Plan Tests of Fuel Consumption

Wisconsin Good Roads Assn. to Determine Relative Effects of Road Conditions

MILWAUKEE, WIS., Nov. 11—Exhaustive tests and demonstrations to determine the relative consumption of gasoline by motor vehicles on different types of highways, and also on roads in good and bad condition, have been arranged by the Good Roads Assn. of Wisconsin. The tests will be undertaken as soon as possible under the direction of Prof. M. F. White, department of agricultural engineering, University of Wisconsin, with the assistance of F. A. Cannon, secretary of the roads association.

The first tests will be made in Milwaukee county, which contains more than 100 miles of concrete highway, and also many miles of poor dirt, gravel and macadam highways not yet improved, thus offering the extremes of road and haulage conditions. The work will be done in this manner: A wagon will be loaded with a fixed load of agricultural products, say 2000 lb., to which will be hitched a pair of horses. By means of a dynamometer the tractive effort, resistance or pulling power will be fixed and determined.

—

Allen Bour-Davis Southern Sales Mgr.

DETROIT, MICH., Nov. 11—Robert Allen has been made the southern district sales manager for the Bour-Davis Motor Co., Mr. Allen was formerly the manager of the Dallas, Tex., branch of the Chevrolet Motor Co.

—

Livingstone Maxwell Cleveland Manager

CLEVELAND, Nov. 12—J. Livingstone has been appointed manager of the Cleveland retail branch of the Maxwell Motor Co. Mr. Livingstone was formerly assistant branch manager for the Studebaker Corp. at Indianapolis and Omaha.

—

Cole Has Service Conference

INDIANAPOLIS, IND., Nov. 10—More than 100 service men employed by the various important distributors and dealers of Cole cars have been assembled in Indianapolis by the Cole Motor Car Co., for their first service men's conference to outline a new service program which has been adopted.

—

Miles Is Buyer for Lewis Motor

DETROIT, MICH., Nov. 13—F. E. Miles has become the purchasing agent for the Lewis Motor Corp. Mr. Miles was formerly connected with the National Motor Vehicle Co.

Paige Wins Desert Race

Negotiates 273-Mile Phoenix-Douglas Course in 8 Hr. 30 Min.—14 Entered

PHOENIX, ARIZ., Nov. 13—E. L. Cord, driving a Paige, won the 273-mile Phoenix road race in 8 hr. 30 min., or 30 m.p.h. P. Thomason, driving a Buick, came in third, his time being 8 hr. 40 min. Fourteen cars started and five of them finished.

Entry in the race was open to cars and drivers from Arizona, New Mexico and Texas, with the condition that both driver and entrant must have been a resident of one of the three States for 6 months prior to the race. The race started at Douglas and finished at the State fair ground, Phoenix. The course followed the Borderland highway from Douglas to Phoenix, including some of the fastest stretches of desert road in the southwest and some tortuous sections of mountain and desert road. Hugh Miller holds the course record of 7 hr. 4 min., in 1914, made in the Pope-Hartford that he drove to-day. The race was conducted under sanction of the A. A. A. and by the Arizona State Fair Commission.

—

Uniontown Speedway Nears Completion

UNIONTOWN, PA., Nov. 13—The local 1⅛ mile speedway is now nearly completed and will be ready for practice the latter part of next week. The total number of entries to date for the race meet on Nov. 30 is fifteen. In addition to the $4,250 offered in cash prizes for that day, C. W. Johnson, president of the speedway association, received a special prize in the form of a trophy valued at $3,000, to be known as the Universal Trophy, presented by Carl Laemmle, president of the Universal Film Mfg. Co. This trophy is to be contested for a period of 5 years at Uniontown, according to the terms on which it is offered.

—

Maxwell Makes Speed Test Run

DETROIT, MICH., Nov. 11—A Maxwell stock car, driven by Ray McNamara, completed a speed test from Detroit to Kalamazoo and return in 9 hr. and 45 min., covering a total distance of 350 miles, with an average running speed of 36 m.p.h.

The test was held, preliminary to the engagement of a Maxwell stock car in a contest which may arise as a result of the Maxwell challenge issued recently to all cars selling for $1,000 or less. The route taken included the towns of Lansing, Grand Rapids, Kalamazoo, Battle Creek, and Jackson, and the run was officially observed and checked by Detroit newspaper men. More than 50 per cent of the run was made over roads that were in the worst possible condition for touring and in several places the car was forced to make long detours because of construction work.

The start was made from Detroit at 3.15 a. m. and the car was checked into Detroit at 1 p. m.

—

Chevrolet Makes Promotions

OAKLAND, CAL., Nov. 13—R. C. Durant, son of W. C. Durant, has become sales manager of the Chevrolet Motor Co. of California. He was formerly assistant sales manager. W. A. Coleman has become assistant sales manager. Norman DeVaux has become general manager of that company, his former position being sales manager. They will make their headquarters at the local assembling plant.

T. L. Coleman has become sales manager of the Chevrolet Motor Co. of Canada, Oshawa, Ont., succeeding H. Horsman, recently resigned. Mr. Coleman was formerly with the Goodyear Tire and Rubber Co., New York.

—

Milburn Branch Manager for Hupp

DETROIT, MICH., Nov. 14—E. W. Milburn has been appointed branch manager of the Hupp Motor Car Corp. at San Francisco. He succeeds E. A. Morrison. Mr. Milburn was formerly the coast representative for the Thomas B. Jeffrey Co.

—

Timken Employees to Own Store

DETROIT, MICH., Nov. 14—The 3300 employees of the Timken-Detroit Axle Co. plan to reduce the cost of living by the operation of a store owned by themselves. It will be known as the Co-operative Store of the Timken-Detroit Co. and will sell food staples to all employees at the lowest possible prices. L. R. Judson, welfare manager for the company, will supervise it.

—

Vail Rubber Changes Its Name

CHICAGO, ILL., Nov. 13—The name of the Vail Rubber Co. has been changed to Ehman Tire & Rubber Co., under which name the business will be continued. A. C Ehman is president, the other officers being Francis Lackner, vice-president and N. J. Flynn, treasurer. The company makes pneumatic tires, packing, gaskets, and mechanical rubber goods.

—

Olympian Offices in Pontiac

PONTIAC, Nov. 13—The general offices of the Olympian Motors Co. have been moved into the main office building formerly occupied by the old Flanders Mfg. Co.

Amateur Races for Chicago?

Series May Be Run on Speedway Under Mid-West Motor Club

CHICAGO, ILL., Nov. 10—It seems possible that next year will see a series of amateur races run on the Chicago speedway quite similar to those that were fortnightly events on the Brooklands track prior to the war. These races probably will be run under the auspices of the Mid-West Motor Club, which was formed this week by a number of those who took part in the amateur races held here this year and present plans include competition among all cars up to and including 230 cu. in. piston displacement.

—

American Speedways Assn. Formed

CHICAGO, ILL., Nov. 15—Speedway managers met here to-day and formed the American Speedways Assn. in the form of a national organization to standardize racing conditions and to draft up uniform regulations and co-operations in getting drivers in all events.

The meeting to-day held at the Chicago Automobile Club is the culmination of a number of previous futile attempts to organize during the past 18 months.

At this meeting a constitution was adopted and officers elected as follows: president, Harry Harkness, New York Speedway; vice-president, Allison, Indianapolis Speedway; treasurer, H. S. Lehman, Cincinnati Speedway; and secretary, T. E. Meyers, Indianapolis.

The following speedways had personal representatives present; Indianapolis, Uniontown, New York, Providence, Des Moines and Chicago. Cincinnati and Omaha sent proxies.

In the newly formed organization there are two classes of membership. Class A is open to speedways having a course of 2 miles in length or over and class B is open to speedways having a course of less than 2 miles. In each case those speedways will be admitted whose construction is approved by the membership committee of the association. Chief control will be in the hands of a governing board consisting of three representatives of class B and four representatives of class A. The governing board consists of Allison, Harkness, Reid, Lehman, and C. W. Johnson, of Uniontown, as class A members. F. H. Perkins, Providence and Samuel Orloff, Des Moines, are members of class B. The governing board and officers elected will serve until the next meeting in New York, Jan. 12.

The American Speedways Assn. supercedes the Speedways Assn. of America which it was intended to organize earlier in the year.

The Automobile

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Convincing Advertising

THE advertisements of the concerns constituting any industry is in general a good indication of the business ethics of that industry. In all new industries more or less undesirable advertising is bound to be published, but it is a satisfactory indication when a national organization such as the National Automobile Chamber of Commerce takes up the problem of advertising with the object of discouraging what might be classed as scare or fear copy and lending its influence to more positive forms of publicity.

Potential Quality Doubted

While scare, or fear, advertising might be looked upon as potential still it is questionable, after administering the psychological test, if such copy is as potential as other copy might be. There is generally a positive and a negative aspect to each subject. A good positive example of advertising is that of the Pennsylvania Railroad, which advertises the number of passengers it has carried over a certain period without a single loss of life. It would be difficult to find a more potential kind of copy. Other positive railroad advertising has had to do with block-signal systems, rock-ballasted roadbed, full crews and other assets.

Contrast such advertising with that copy which might be used, showing trains on their side in the ditch, passenger cars on fire and women and children being rescued, engines colliding head-on and trains crashing through weak bridges. Such fear copy that might be used would in general build up through the traveling clientèle a feeling of fear, a feeling that would not engender a love for travel, but that would rather induce you to stay at home. The effect would be negative rather than positive.

Negative Tendencies Undesirable

In all advertising copy relating to automobiles and the industry the message to be conveyed is not one of fear or scare but one of desire to own and use an automobile. Every picture used in an advertisement that suggests accidents and the horrors that follow them is a possible source of injury. It has a negative tendency in that its influence breeds fear for the automobile rather than confidence in it.

Clutches and Winter

MISSING motors and clashing gears seem to be particularly common in the cold weather which has just commenced to settle over the country. The first item can of course be laid at the door of the heavy fuel which is difficult of vaporization. The second, however, can be traced to a defect which should be rectified in some of the clutch designs.

There is a tendency to drop the clutch brake and in place of this substitute a quick releasing device which will disengage the driving from the driven members instantaneously. This trend of design is no doubt a matter of progress, but one phase which must be watched is that the stiff lubricant which is attendant upon cold weather does not interfere with the action of the clutch.

The lighter weight clutches which are coming into use year by year naturally have less tendency to spin, and therefore lessen the danger of clash and also are not prone to drag. The effect of the heavy oil on even a light-clutch member is sufficient at times to give this clash. In fact, it will be so severe in some instances that it is difficult to pull the gears out of mesh after the clutch pedal is depressed, and when they are re-engaged the grinding noise which is particularly noticeable at this time of year ensues.

The remedy is, of course, in having the disengaging mechanism positive as well as quick. At the same time the leverage on the clutch pedal must not be reduced because with the ever-increasing number of women who drive it is necessary to keep in line with the tendency of having the force required to disengage the clutch as small as possible. Furthermore, the amount of motion of the pedal cannot be too great, because it will make the car unsuitable for a large number of leg lengths. This opens up a problem which is of course nothing new to the clutch builder. The amount of clutch member travel must be small, it must be quick to reduce spin, and in all the lubricated forms of clutch it must be absolutely unaffected by changes of oil viscosity due to temperature changes.

Steering Gears Offer Many Opportunities

Details of Layout and Construction Present Field for Enterprise—Truck Type Problems Differ from Passenger Car Requirements—Elimination of Wear

By J. Edward Schipper

STEERING gear design is largely a matter of compromise. It is a compromise between what is mathematically perfect and what is attainable practically; between stress on the driver and stress on the mechanism; and again between quickness of action and effort required to manipulate.

With this three-fold problem, each having its answer in a compromise, it is human to conclude that there will be a great variation in opinion, and this is true regarding the generalities of steering gear design as well as of the details.

Steering gears are probably the part of the car which has undergone the least change in the last 5 years and there are many cars to-day using the same gear as they did in 1912, with the exception of a few refinements in the direction of reduced weight and the changes required in shifting the gear from the right to the left side of the car.

Two big factors enter the design of the steering gear, and these determine practically every point in relation to the gear. They are:

First—the car weight.

Second—the car speed.

The layout of the gear is governed largely by the wheelbase and the structural details of the frame, but the steering gear itself depends upon the two factors named.

Truck Designs Differ

Because a truck is heavier and slower than a passenger car, it necessarily has a different kind of steering gear. Theoretically the layout would be the same for both machines if they were of the same wheelbase, but practically, it is necessary to have a great reduction in the truck because it is heavier and naturally takes a greater leverage to turn the wheels; and secondly, since the truck acts at a slower rate of speed, the reduction can again be greater because it is not so necessary to be able to turn the wheels from one side to another so quickly.

Owing to the great inertia of a moving loaded truck it is not desirable to make quick turns with the front wheels on account of the tremendous stresses involved by the inertia force and the high center of gravity. With a passenger car, the wheels must turn quickly in order to make the vehicle good for traffic work.

The passenger car problem calls for the reduction gear in the steering mechanism to have a final ratio that will give the result desired in quickness and at the same time the gear must prevent the reception of road shocks by the driver, or, in other words, it must not allow the wheels to be swung out of their proper line or the steering wheel turned by every little impact between wheels and road obstructions. In other words, the gear must be to some degree irreversible.

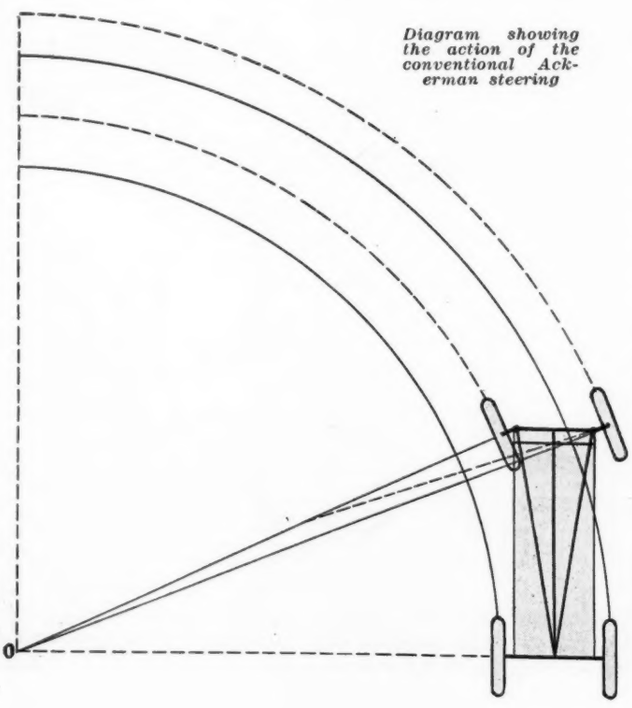


Diagram showing the action of the conventional Ackerman steering

The term irreversible in itself is confusing, because it has no exact meaning when applied to steering wheels beyond the rather indefinite condition that it means that any ordinary road wheel impact will be insufficient to turn the steering wheel. It is simply a question of reduction between worm and gear, sector or nut, whichever system is used. The greater the reduction, the less reversible the system and likewise the slower the motion of the road wheels in relation to the movement of the steering gear. Hence,

the steering gear for a heavier car will be normally less reversible than the steering gear for a lighter vehicle.

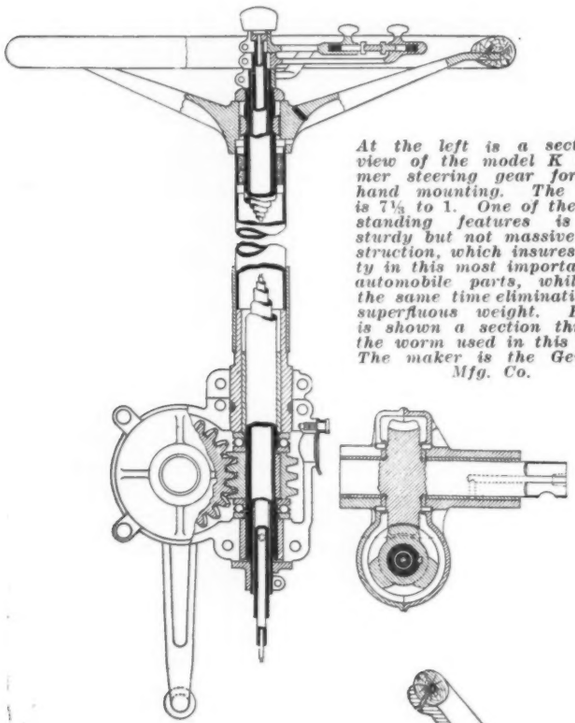
Elimination of Wear

The straight mechanical problem of steering gears is to eliminate wear. This occurs in all the joints, the order of progress of wear being first the link joints at either end of the drag link and tie rod; and next between the worm gear or nut and the swivel joints. The order of wear is very much the same as the order of lubrication difficulty, and where the different steering gears differ largely is in these points where different styles of ingenuity are employed to get the joints so that they will retain the grease and at the same time allow it to be applied at the proper points.

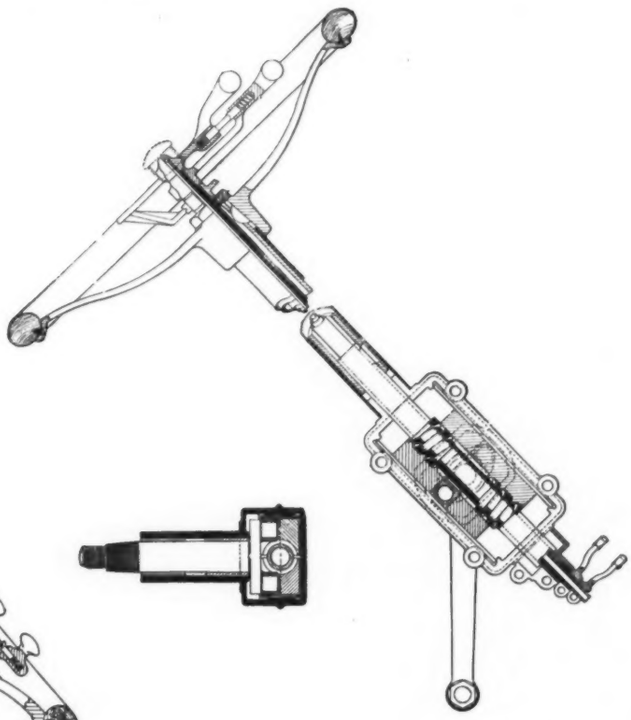
There is also a variation in the grades of lubricant used. The Warner company, for example, recommends a heavy graphite grease as a general rule, although it states that in very cold weather a thinner oil would be of advantage. The great point of importance is that the oil or grease is retained in the gear once it is put there so that the operation of oiling the gear will not have to be repeated over frequently.

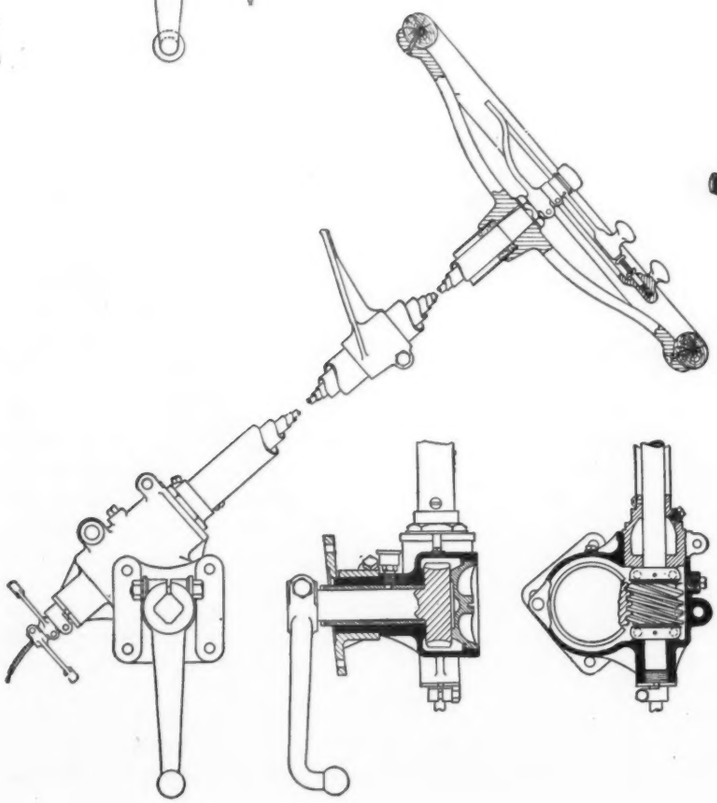
Lubrication Points Inaccessible

There are at least seven important points to lubricate on a steering gear, and none of them is accessible for a man who has good clothes on, therefore, as far as the passenger car owner-driver is concerned, he will not lubricate the gear until two conditions obtain, first that he has on a set of working clothes and second that he thinks of the gear. In many cases the first of these circumstances is rare, and in many more instances the second circumstance is still more rare. The combination of the two, therefore, will be so much of a long chance that steering gears must be designed to hold enough oil and grease to furnish lubrication for a long time. The majority of steering gear manufacturers favor a light transmission grease.



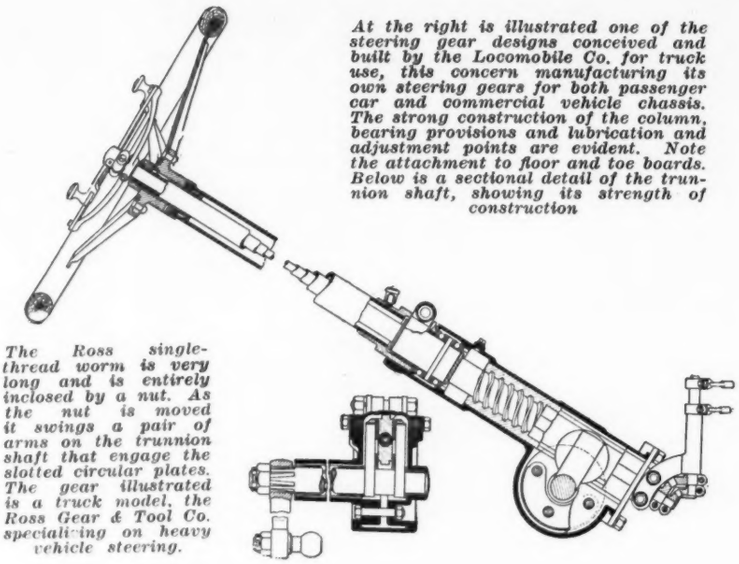
At the left is a sectional view of the model K Gemmer steering gear for left hand mounting. The ratio is 7½ to 1. One of the outstanding features is the sturdy but not massive construction, which insures safety in this most important of automobile parts, while at the same time eliminating all superfluous weight. Below is shown a section through the worm used in this gear. The maker is the Gemmer Mfg. Co.





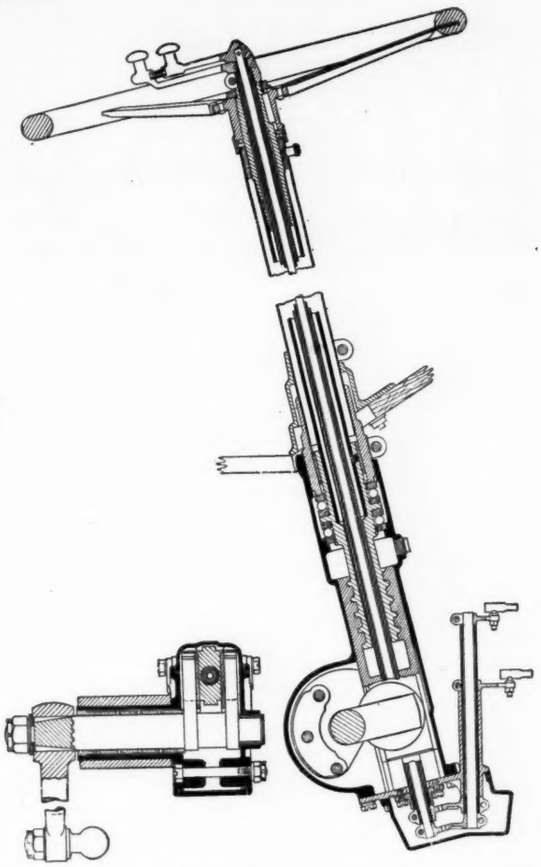
Above is the Lavine gear which uses a divided nut operating on right and left hand threads cut in a double worm, each of the blocks of the nut having a worm. The steering arm is operated through a rocking arrangement. To the left of the steering gear is a detailed section showing the trunnion shaft, its bushing, trunnion block, etc. The Lavine Gear Co. is the manufacturer

To the left is a Warner steering gear which is widely used and which is representative of modern worm and wheel practice. There is an adjustment for the thrust bearing behind the worm. Note the bracket midway up the steering column for attaching to the cowlboard or dash and also wiring for the horn. Immediately to the right of the steering gear is a sectional view showing details of the trunnion shaft and farther to the right is a similar illustration of the worm assembly. This gear is made by the Warner Gear Co.



The Ross single-thread worm is very long and is entirely inclosed by a nut. As the nut is moved it swings a pair of arms on the trunnion shaft that engage the slotted circular plates. The gear illustrated is a truck model, the Ross Gear & Tool Co. specializing on heavy vehicle steering.

At the right is illustrated one of the steering gear designs conceived and built by the Locomobile Co. for truck use, this concern manufacturing its own steering gears for both passenger car and commercial vehicle chassis. The strong construction of the column, bearing provisions and lubrication and adjustment points are evident. Note the attachment to floor and toe boards. Below is a sectional detail of the trunnion shaft, showing its strength of construction



In the design of the gear itself, it is generally believed that the kind of gear employed is not so important as to have the gear of proper design. This materially affects the lubrication, as it bears directly on the pressure exerted on the surfaces. The pumping effect on the steering gear is very slight, so it is difficult to keep the lubricant properly distributed and therefore another feature to compromise arises. The unit pressures must be kept down on one hand, and, on the other hand, the thread area of the worm must not be too great.

The Two Schools of Design

Referring this matter to the two different schools of design, the worm-and-split-nut and the worm-and-gear, the probabilities are that in the worm-and-gear type the pressures run quite high, because of the nature of the gears there is simply a line contact; whereas with the worm-and-split-nut type the thread area has a tendency to become so large that it is difficult to permit the lubricant to reach the innermost threads unless a very light oil is employed.

Allowable Backlash

All the wear in the different joints is reflected in backlash in the steering wheel. Fortunately, adjustments are provided on all the gears to get this lash out, because it becomes annoying at first and then dangerous, as a car with too much is apt to commence swaying on a down grade, and the sway becomes greater and greater until it reaches the limits of safety unless retarded.

Exactly what should be the allowable backlash in the steering wheel is subject to a difference of opinion. The Jackson, Church and Wilcox company states that the ideal is a 0 backlash. Warner states from 1 to 1½ in. is permissible. As a matter of fact, everyone knows that it should be kept as small as comfortable. Even drivers will differ, however, on what constitutes a fair amount of play and what is bothersome, but the steering gear manufacturer cannot adjust every product to the individual desires of the driver, so a standard has to be set and adhered to in each factory, and this ranges between the limits of practically 0 to 1½ in. A slight play generally helps to reduce shock.

Steering Pivot Tilt

If there is one change in steering gears, it is probably in arranging the steering pivot tilt. This has been increased in the last year or two, in order to help in attaining the so-called castor effect. In laying out the steering gear on the Willys-Overland cars, an angle of more than 5 deg. is given every steering pivot, to make it hold the road. On the other hand, a tilt of more than 10 deg. is extreme and it will be very difficult to make the car hold a turn on account of the great tendency for it to straighten out. This would make a desirable car on a long, straight road, but an undesirable one on a twisting road. Here again there must be a compromise and a moderate tendency to straighten out gained, without causing a tiring effort to hold the wheels on turns.

Tilting the Axle

Tilting the axle gains the same effect as tilting the steering spindles and even the flattening of the front springs has been a decided help in making cars hold the road. It is not all design, however, as soft front tires will counteract the best of steering layouts, or if the weight on the rear axle is greater than that on the front, there will be a decidedly unbalanced car to drive, the tendency being for the car to try to have the rear end catch up with the front wherever the course deviates from a straight line or lies over a slippery stretch.

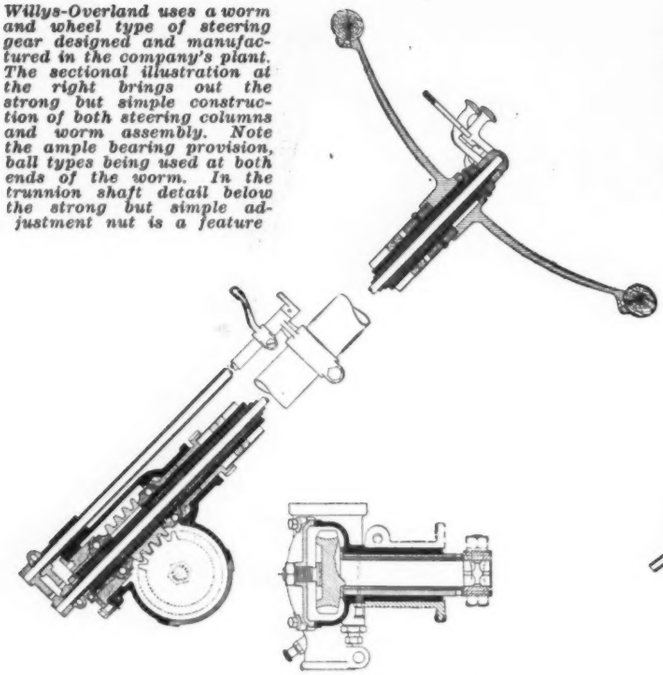
Adjustments Are Complete

Steering gears are all particularly complete in the matter of adjustments. This allows the driver to hold the backlash in the gears to just about the desired amount. Play in the wheels that is not detected in the steering wheel is due to variations in tightness of the linkage, and signifies worn parts, generally those which have either been neglected by the driver or which have bearing surfaces that are too small for the loads the gear is called upon to stand and hence have worn away too rapidly.

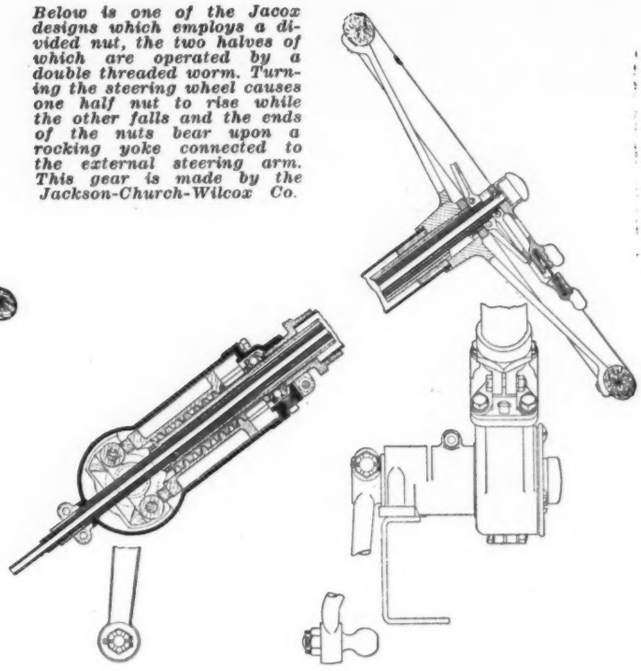
Bearings Are Renewable

Bushings are renewable even in the case of the worn parts, so that steering gear maintenance is really on about as good a basis as anything on the car. The trend of the times, however, will probably cause an improvement in gears in the

Willys-Overland uses a worm and wheel type of steering gear designed and manufactured in the company's plant. The sectional illustration at the right brings out the strong but simple construction of both steering columns and worm assembly. Note the ample bearing provision, ball types being used at both ends of the worm. In the trunnion shaft detail below the strong but simple adjustment nut is a feature



Below is one of the Jacox designs which employs a divided nut, the two halves of which are operated by a double threaded worm. Turning the steering wheel causes one half nut to rise while the other falls and the ends of the nuts bear upon a rocking yoke connected to the external steering arm. This gear is made by the Jackson-Church-Wilcox Co.



way of self-lubrication and again in self-adjustment. The self-aligning feature comes with the castor effect, the others are still waiting for full development. Oilless bearings are suggested for parts of the gear that do not have a great amount of motion, and they have been tried extensively and are in some use.

Worm-and-Wheel Adjustment

With the worm-and-full-wheel gear there are two adjustments possible; one method is to turn the eccentric bushing at the center of the wheel and the other is to turn the wheel, bringing a new surface into engagement with the worm. As the whole wheel is not used at once, this gives all of the effect of a new wheel. The latter method is generally preferred by manufacturers and it is recommended that the adjustments be made generally in this manner.

With the worm-and-split-nut type of gear, adjustments are simple. The Jacox gear is an example, as the gear is adjustable for wear by one single adjustment, and this is quite accessible. The adjustment is accomplished by loosening the bolt in the housing cap which locks the adjusting nut. The adjusting nut is then screwed down and locked. The adjusting nut bears directly on the thrust bearing which rests on the shoulder of the screw. When the adjusting nut is turned down, the screw is forced down against the threads of the half nut, the half nuts are in turn forced down against the rollers of the yoke shaft, taking up the wear on the threads of the half nuts and on the rollers.

Mechanical Layout Problems

Mathematically the layout of the steering gear presents a problem with ramifications that are not approached in any other part of automobile design. The mere statement of the problem of getting two pairs of wheels, one stationary and the other movable axially, to roll around a given point without sliding is sufficient to indicate the impossibility of ever securing in practice mathematically correct steering. As a matter of fact, the variation from the perfect is not so great as would at first be supposed, and although it cannot be said that the past year's improvement has brought us any closer to it, still steering, taken as a whole, is not unsatisfactory.

Practically every automobile has the same type of steering so far as the system is concerned, the Ackerman. With Ackerman steering it is assumed that the tie rod arms projecting from the swivels should meet at the middle point of the rear axle if their center lines are produced. Now, when on a curve the two rear wheels roll on two circular paths of different radii, and each wheel makes a tangent to its rolling circle, as viewed in plan. The front wheels meanwhile roll on separate circles of their own and the ideal steering gear is such that each of the four wheels should make a tangent to the circle along which it is rolling.

This true rolling can occur at three positions only: One is the straight position when the car is turning neither to right nor left, and the other where two wheels are at some definite angle of lock to right and left respectively. The effect for all other positions is that three wheels may roll perfectly, but the fourth must do some skidding, or perhaps two wheels roll and the other two divide the skid.

When Skidding Occurs

It is obvious that the rear wheels must roll on concentric circles and that the rear axle center line produced must be the diametrical line of the circles. Thus neither one of the rear wheels can skid unless both do. Suppose the point about which the car is turning is O, then the center lines of both the front wheel spindles must meet at O if every wheel rolls perfectly, without skidding. It is obvious that by turning the steering wheel we can bring one of the front wheels into such a position that the spindle center line passes through O, but the second front wheel will then take up a position depending upon the length of the tie rod and the layout of the tie rod arms.

Necessarily a Compromise

The practical geometry of steering gears involves a considerable amount of thought regarding the angles of the links and the intersections of link lines produced, and, as stated, the result from a commercial standpoint must always be a compromise. The difference between really good steering, however, and that of the average car is so marked that any improvements which would tend to make practice line up to a closer degree with theory would be welcomed, not only by the car owner but also by the industry.

Gearsets Simplified and Refined

Main Elements of Design Practically Unchanged—Adaptation to Unit Power Plants and Center Control a Continued Development—Provision for Tire Pump and Speedometer Drive

By Donald McLeod Lay

GEARSETS and clutches are so nearly inseparable in these days of unit power plants that the latter may well be included in a summary of the tendencies and refinements which mark the progress of gearset design during the past year. As was the case in 1915, there have been no radical alterations in construction or changes in basic principles. The leading tendency manifested during this year may be characterized as a general trend toward simplification, not only in manufacture and in the number and type of gearsets produced by each factory, but also in the reduction of the number of parts and slight alterations in the design of others which succeed in doing away with more or less complication and its inevitable accompanying weight.

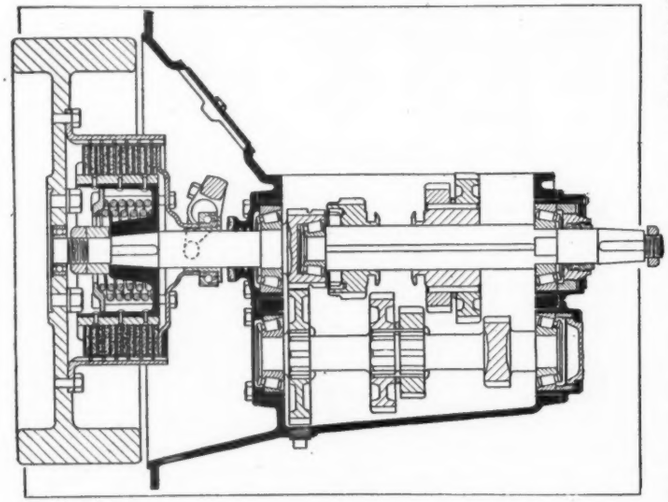
Unit Power Plant Gains

The continued trend toward unit power plant construction which became evident to such an extent last year has been emphasized by the increased production of multiple-cylinder engines, most of which are of the unit design. Naturally, gearsets have been improved in their adaptability to this type of mounting, not only by the methods of attachment, but also by the shape and construction of the bell housing, mounting of the clutch and improved bearing arrangement, although there has been comparatively little change in the latter respect. It was pointed out last year that the general adoption of the unit power plant had not led to the use of plain bearings throughout the gearset with pressure lubrication from the same oil pump that supplies the engine, and the comment was made that this seemed remarkable in that such a development could logically be expected. This year, however, there has been no trend toward such a construction. The manufacturers have not been idle on this question, but those who have been conducting experiments in the effort to arrive at a practical solution of the problem report almost unanimously that difficulty of securing satisfactory lubrication has to date rendered this impossible. Thus, ball or roller bearings continue to hold in practically all constructions for both portions of the mainshaft and, in fact, while some may consider them slightly more noisy than the plain bearing which they consider as the ideal, all the makers recognize their efficiency as a very close approximation of the latter.

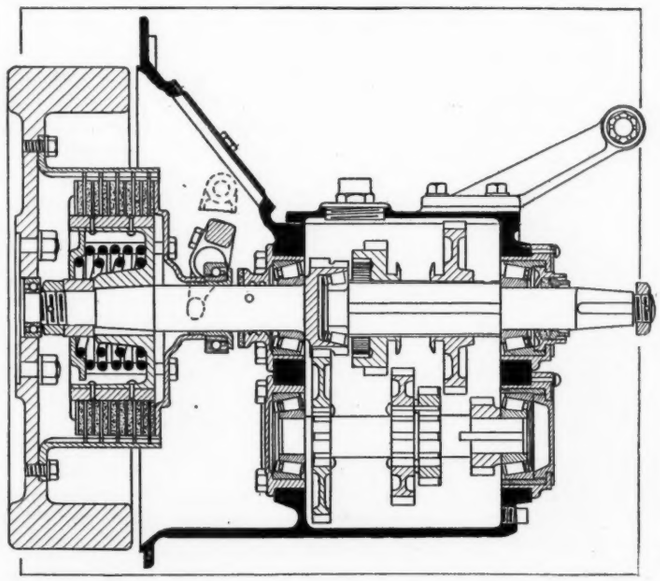
Iron has been increasing in favor as material for gearset housings, largely due to two considerations. One of these is the present high price of aluminum, and the other is the fact that iron seems to make a quieter casing than aluminum, in spite of being a more resonant metal. The greater rigidity of iron is one explanation put forth for this apparent contradiction.

Center Control Still Growing

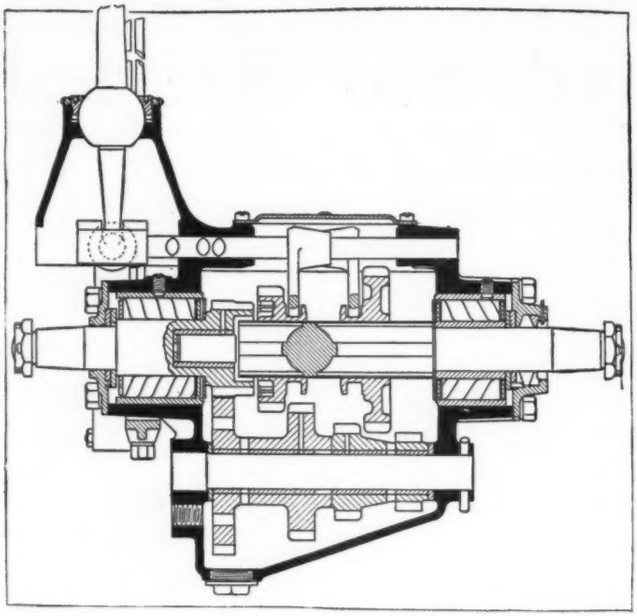
Center control, like the unit power plant construction, has been gaining so steadily that it is now almost standard, especially in the small, low-priced cars. The gearset manufacturers have welcomed this trend from the beginning, as it simplifies their work not only in designing and manufacturing their product, but also in the matter of expense, as it eliminates an enormous amount of material for rods, shafting, etc., which was formerly used up in adapting the stand-



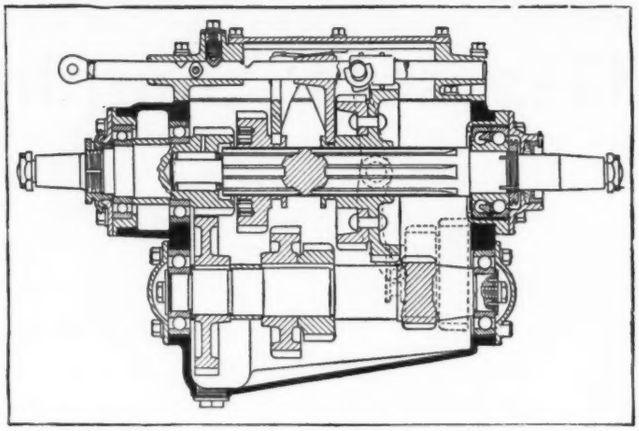
Above—Brown-Lipe four-speed gearset for unit power plant mounting. The company finds the demand for four-speed types for commercial car work to be gradually increasing, this applying especially to 3½ and 5-ton trucks. Where used for this purpose the gearset is universally furnished with direct drive on fourth speed



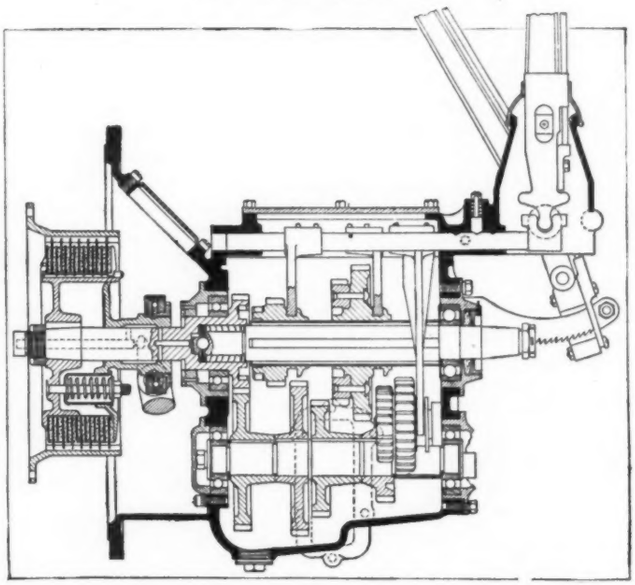
Right—Three-speed Brown-Lipe gearset, which is very like the four-speed design, having the same taper roller bearings. The sliding shaft is of square section. The use of a double clutch spring is characteristic of Brown-Lipe practice



Warner three-speed and reverse gearset with gears at ¾ in. space and 6-8 pitch. The main shaft is round in section with four integral keys and is carried at one end in a Hyatt roller and the spigot at the opposite end in a plain bushing with oiling facilities adequate to all conditions



Warner four-speed and reverse gearset with both shafts carried on annular bearings and with a spigot end of the main shaft carried on a roller bearing within the stub shaft. The main shaft has six splines on which the sliding gears move. The gears are nickel steel 1¼ in. face and 5-7 pitch. The speed reductions are: 4.99-1; 3.16-1; 1.79-1; 1-1, and reverse 5.78.1. Single race annular bearings are used for the countershaft. There is a double race bearing at one end of the main shaft and two single race bearings well spaced to support the short shaft at the opposite end



Warner four-speed and reverse gearset with nickel steel gears ¾ in. face and 6-8 pitch. Single race annular ball bearings carry both shafts. The spigot bearing on the end of the main shaft is supported in a Hyatt roller within the short shaft, and at this point end thrust is taken by a single ball. The gear ratios are: 2.73-1; 1.53-1; 1-1 and 1-1.251. The clutch assembly is a multiple disk type

ard gearset to the special requirements of various chassis.

While some of the gearset concerns still make it a practice to bring out special designs of housing cover plate and control lever mounting to suit the requirements of their customers, the majority build a standard design for center control chassis and adapt it to varying constructions by bending the levers either hot or cold. Regular models are usually available for right and left side lever mounting.

During the past year the makers have been able to still further simplify and refine their control mountings as compared with the 1915 designs, and many of them have arrived at such a point of development that it is necessary to cut only one hole in the floorboard for the passage of the levers, which are mounted, almost as a rule, upon the tops of the gearboxes. The connections between the control lever and the gears have been minimized and shifting is now very simple, requiring almost the least possible number of motions through the smallest distance, besides calling for the expenditure of considerably less energy than was the case in previous years. Last year much progress was made in this direction with the gearsets, but clutches lagged somewhat, a situation which has largely been remedied during the past 12 months by the increased popularity and more general adoption of the dry-disk type, which has now secured a commanding lead over its old rival, the cone. One of the greatest advantages of the dry-disk type is that the inner member can be made extremely light, so that shifting becomes correspondingly easy. Furthermore, for such a light-weight clutch no clutch stop or brake is necessary and the action is equally easy whether the operator is changing from an upper gear to a lower or the reverse. A good clutch brake makes the upward shifting with a cone clutch as easy as with the disk type, provided the weight is kept fairly low, although the extremely light construction which characterizes the dry disk is out of the question with a cone construction.

Clutches Are Better Inclosed

Clutches naturally share in the advantages conferred upon the gearsets by improved methods of inclosure. As an example of the progress made toward the ideal of a small, light, compact clutch unit of maximum efficiency as a transmitter of power, the Borg & Beck three-plate, dry-disk type may be mentioned. This unit also is fitted with a simple method of adjustment, requiring only the shifting of two bolts arranged diametrically opposite one another and working in slots in the housing. One mount produced by this firm combines a flywheel and clutch chamber in one casting. The other model is characterized as a self-contained design, the clutch being furnished in a separate inclosed casing which has a mounting-flange that bolts against the flywheel web.

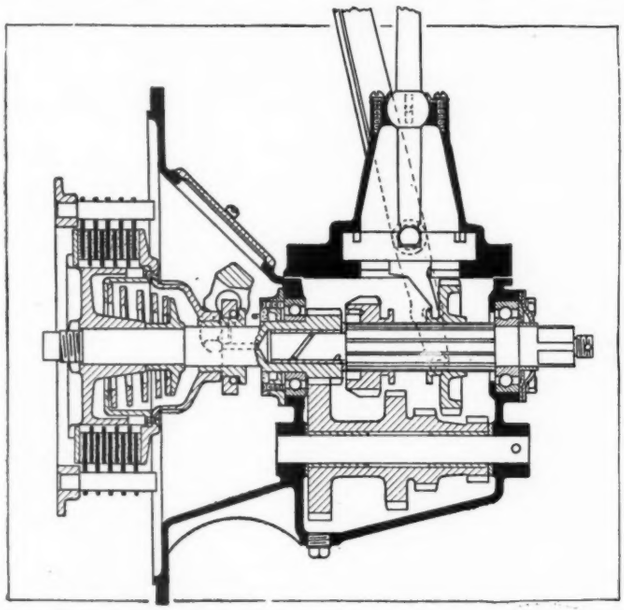
One of the special features of this clutch is the ease of cleaning. Kerosene may be squirted into it, washing out the gummy substance which is caused by the sediment which mixes with the oil. The clutch may slip for a time after the kerosene has been applied, but the slippage soon disappears.

The four-speed gearset is now used in only a few of the

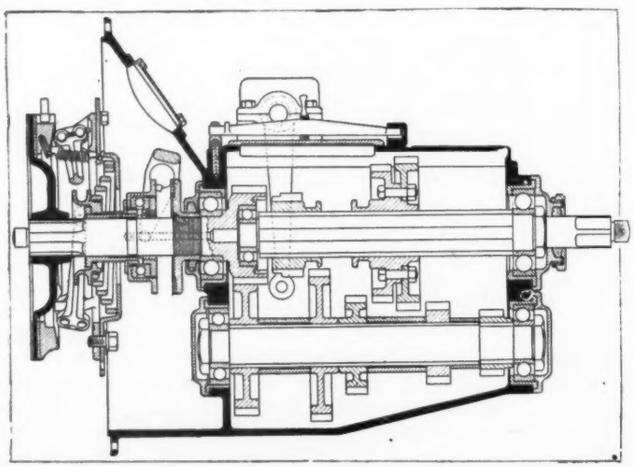
high-priced cars, the development of multiple-cylinder engines rendering it unnecessary except as an additional refinement or touch of luxury. Three speeds may now be considered practically standard for gasoline passenger car construction. For truck use, however, the four-speed gearset is becoming increasingly popular, Brown-Lipe pointing out that this type is in growing demand, especially for 3½ and 5-ton trucks. The Cross Gear & Engine Co. finds an increasing demand for 1-to-1 ratio on high where four-speed constructions are used for commercial vehicle chassis.

Gear ratios have been determined by the manufacturers largely through observation during years of experience and experimentation. Brown-Lipe is an example of this, others being Mechanics Machine Co., American Die & Tool Co. and Grant-Lees Gear Co. The Warner Gear Co. states that too much variation in the conditions of the range covered by standard models prevents the provision of ideal gear reductions. This company endeavors to arrange the gears approximately in geometrical progression, varied of course, according to circumstances.

There seems to be some tendency toward the wider use of a stationary countershaft. Either plain bushing or straight roller bearings within the countershaft gears are used as a rule. With the Warner Gear Co. construction the countershaft gears are cut in pairs mounted on plain bronze bearings and the two pairs are driven by clutch jaws between them. Integrally forged countershaft gears are used by a number of makers, the Mechanics Machine Co. using this construction on the four counter gears used in its smaller gearsets. Brown-Lipe makes the three smaller gears integral in its smallest model, mounting them on a plain-bearing countershaft. The American Die & Tool Co. uses a built-up countershaft with sliding gears bolted together in one model while in another it uses the solid forging with extensions at the ends which support it in the case and which run on ball bearings.



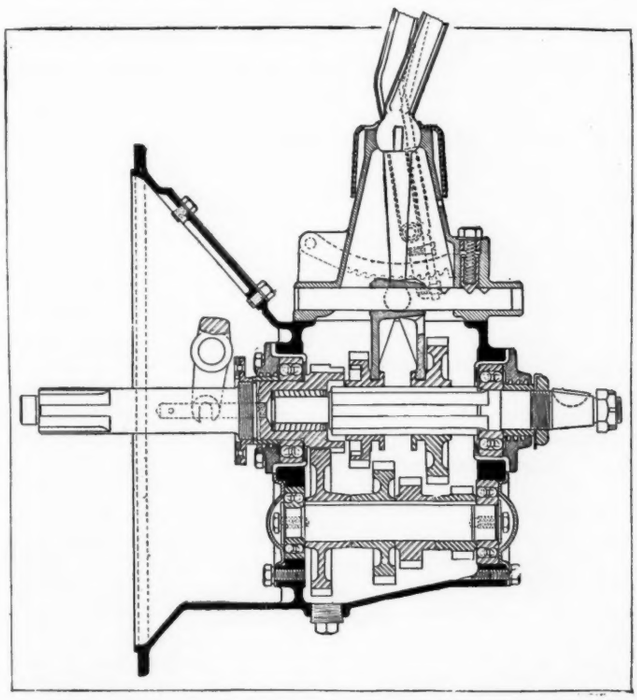
Mechanics Machine Co. three-speed and reverse gearset in which the main shaft is carried on annular bearings and the countershaft on plain bearings. The spigot end of the main shaft is carried in a plain bearing within the stub shaft. The main shaft is splined for the sliding gears. The ratios are: 1.5-1 on intermediate, and 3.4 to 1 on low. The clutch assembly is a multiple disk type with an inclosed conical engagement spring. There is a ball thrust collar for clutch disengagement



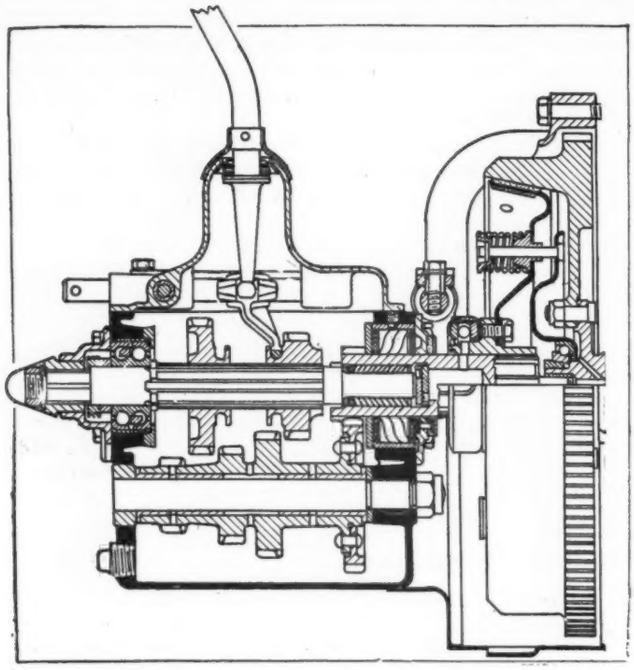
American Die & Tool Co. four-speed and reverse gearset with ball bearings for carrying main and countershaft as well as the spigot end of the main shaft. The main shaft is a circular cross section with 4-in. integral keys. The clutch assembly is a three-disk type with conical engagement spring and ball thrust collar for clutch actuation

Interlocking Devices Universal

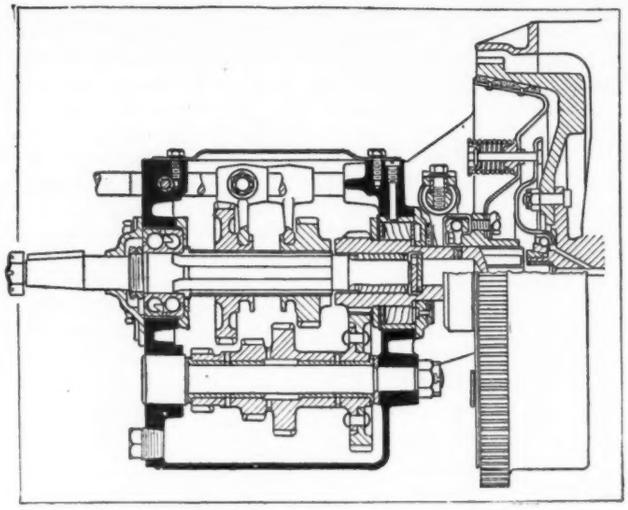
Interlocking devices to prevent the meshing of more than one gear at a time are almost universal. The Warner Gear Co. employs vertical plungers to give the gears their proper meshing position and plungers with a cross movement prevent more than the shift rail being moved at any given time. The Mechanics Machine Co. uses a small steel plate cast into the gearbox cover, this plate being notched for the gear change lever so that it is impossible to engage two speeds at once. When one set of gears is in mesh the lever is at one side of this plate and it is necessary to bring this through the notch and over to the other side of the plate before another set of gears can be brought into mesh. Three types of interlocks are used by the American Die & Tool Co., the ball or rod with spherical end between shift rods and the tilting bar mounted on a bracket underneath the sliding forks which



Grant-Lees three-speed type of gearset. Gears are renewable separately and only one control housing is made. This is designed so that it is necessary to cut only one hole through the floorboard, the levers being bent cold to accommodate different bodies. Grant-Lees has changed from the gland stuffing box type to the spiral lead end plate



Northway three-speed design with reductions in the gearbox of 3.09 to 1 on low gear, 1.73 to 1 on second and direct drive on third. The reverse ratio in the box is 3.98 to 1. These ratios are, of course, multiplied by the rear axle for final reduction. The clutch used in this installation is a cone type with a ball bearing release

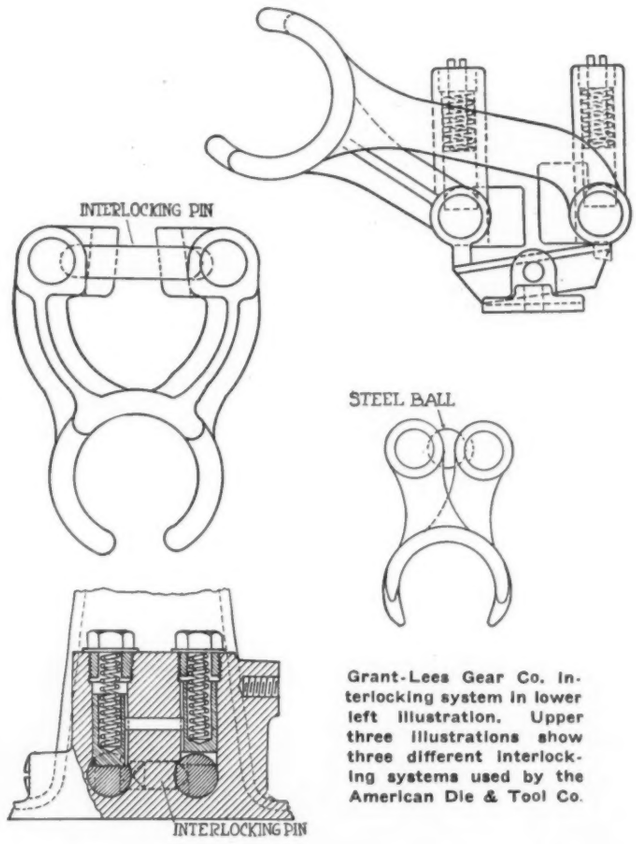


Northway gearset with main shaft on double annular ball bearings at one end and the short shaft at the opposite end supported on spiral roller with a similar bearing supporting the spigot. The clutch assembly is a cone type with small engagement springs regularly spaced. The countershaft is carried on plain bearings

is pressed into a notch in either fork when moved from neutral. Grant-Lees uses an interlocking pin fitting between the two pull rods, the grooves in which are deep enough to accommodate this pin in neutral position to allow either pull rod to move forward or back but the guide hole in the control housing prevents the other pull rod from moving while one rod is out of the neutral position, either forward or back. The pin is hardened and very little wear is said to take place in continual use. In a new constant mesh four-speed design which Cross Gear is bringing out for truck and bus work, there is a special locking device, which is said to be positive in its action. Two of the shifting fork shafts are held in neutral position by locking pins, which pass entirely through them, while the third shaft is shifted into the required position.

Gear Face and Pitch

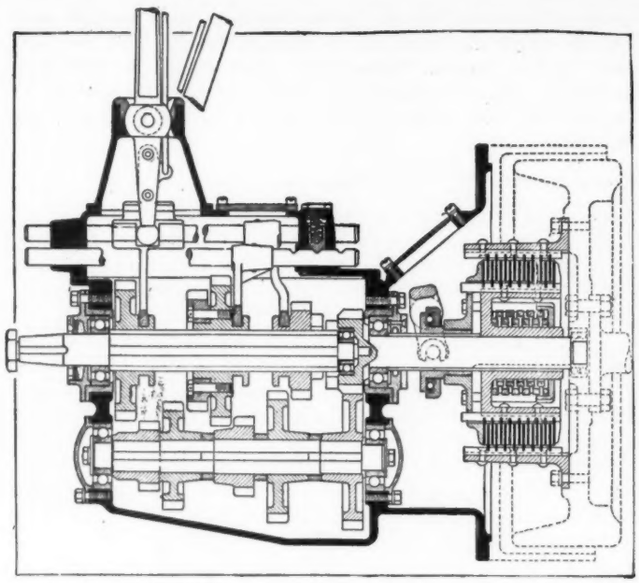
There seems to be a considerable difference among the gearset makers as to the quietest and most efficient types of gears in respect to pitch and width of face. Warner considers the finer pitch gears and those of narrower face as less likely to create noise, making the point that distortion is unavoidable during the hardening process as applied to wider gear faces. Brown-Lipe agrees in this contention but Grant-Lees considers stub toothed, coarse pitch gears more quiet in operation than gears of finer pitch of a given face. Thus for a ¾-in. face gear it finds a 6-8 pitch 20-deg. pressure angle has an advantage over 7-9 pitch 20-deg. pressure angle on account of less distortion in hardening although a coarser tooth 4-5 pitch would not be advisable for the same tooth width on account of the pitch diameters not allowing enough teeth to be in contact. The Mechanics Machine Co. does not believe that pitch and width of gear face have any great effect upon quietness but considers it inadvisable to make gears with less than thirteen teeth, counting on the care and manufacture to insure quiet operation. The American Die & Tool Co. reports that on various tests covering both 8-10 with 9/16-in. face gears and 6 and 6-8 with 1 in. and ⅞ in. face respectively, it has had both quiet and noisy operation.



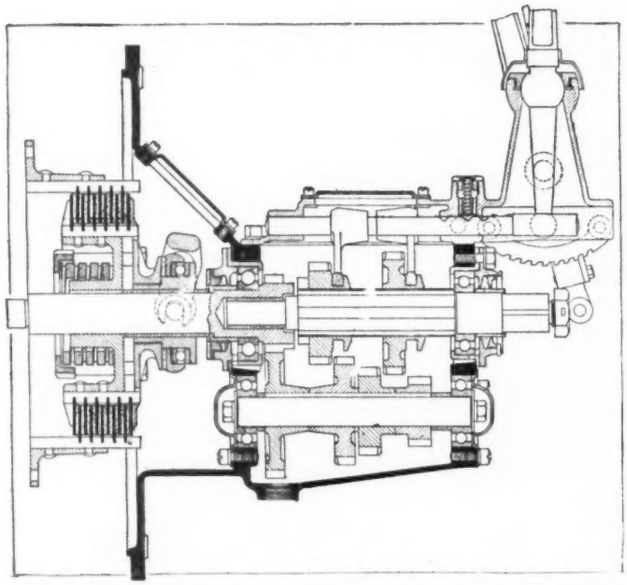
Grant-Lees Gear Co. Interlocking system in lower left illustration. Upper three illustrations show three different interlocking systems used by the American Die & Tool Co.

It points out that the design in both cases has a bearing on the question, and when either of the sets is mounted in the cast iron housing even with ball bearings, noise has been a negligible factor. For standard practice this company considers the 6-8 pitch with the ⅞-in. face as most serviceable. Northway considers pitch, form of tooth and diameter important factors in securing a quiet gearset, the width of the gear face determining the duration of this quietness.

On the whole there is little tendency to make any change of the type or arrangement of bearings. Brown-Lipe uses

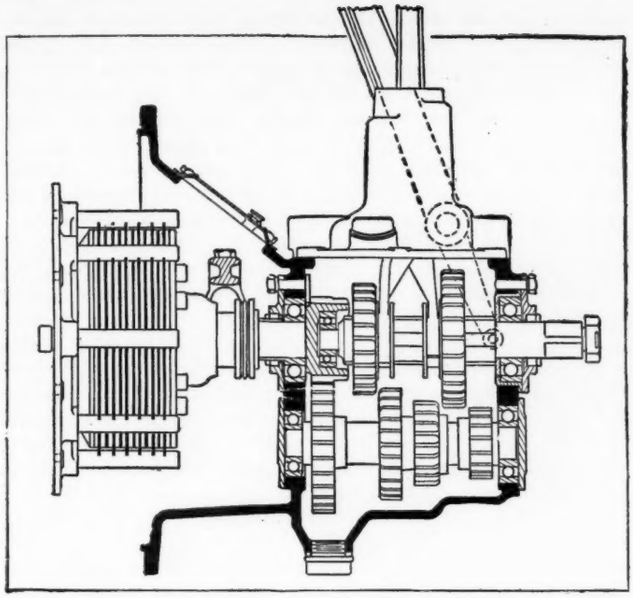


Muncie Gear Works vertical design gearset employing annular ball bearings throughout, including the spigot end of the main shaft. Gears are 5 pitch and ⅞ in. face. There is a ball thrust collar for clutch action and the clutch assembly of multiple disk type employs a double spring. The usual packings at each end of the main shaft are used to avoid leaking



Muncie Gear Works three-speed and reverse gearset using annular bearings throughout except at the spigot end of the main shaft, where a plain bearing is used. Gears are of 6-8 pitch. The main shaft is round section with four integral keys. Gears on the countershaft are held by keyway. The clutch assembly is inclosed within the usual flange construction

taper roller bearings throughout wherever possible in its standard constructions. Warner considers the use of either plain bushings or straight roller bearings within the countershaft gears and in connection with a stationary countershaft to be growing in favor. Northway finds a trend toward the adoption of spiral roller bearings type for the forward end of the main shaft and a double-row ball bearing in the rear. The American Die and Tool Co. has been using ball bearings throughout, its experiments with plain bearings on countershaft and spigot proving unsuccessful because of lubrication difficulties. For eliminating noise and reducing cost of manufacture this company recommends a combination of ball



Fuller & Sons Mfg. Co. gearset employing annular bearings throughout, including the ends of the spigot shaft. This unit assembly is made with flanges to fit all makes of motors

and roller bearings, or roller bearings throughout with a small roller bearing for the spigot.

Tire Pump and Speedometer Mounting

Provision for demounting of tire pump and speedometer is becoming more general with the gearset makers. With the Grant-Lees design the tire pump base can be bolted to the gearset housing and is driven off the reverse idler gear. Northway makes provision on the left side of the gearbox for the application of the tire pump, the drive being secured in the same manner as on the Grant-Lees. Similar constructions or their equivalents are to be found on practically all of the standard gearsets now being manufactured. Speedometer drives from the gearset are now largely inclosed, an example of this being the Northway, in which the speedometer drive is contained in the rear bearing retainer.

Ease of disassembly and assembly has been one of the important aims of the gearset designer for some time and during the past year a number of concerns have made slight improvements in this particular, one of the most salient of which is the practice of having all the parts assembled outside of the case so that they go in as a unit and may be removed in the same way. With the now almost universal central location for the gearshift and emergency brake levers, control members are neatly and conveniently mounted on the cover plate of the gearset housing, which still further simplifies the task of disassembly. Another factor in this situation and one which simplifies to a great extent the matter of replacements, not to mention its accompanying reduction of expense in case of repair, etc., is the increasing adoption of separate units in the gearset which can be easily removed. Thus in case of stripping the teeth of one gear or some similar mishap, the car owner is not obliged to replace a large part of his gearset at considerable expense, as was formerly the case with some constructions.

Differ on Lubrication

In the matter of lubrication there appears to be a wide diversity of opinion among the gearset manufacturers, both as to class of lubricant which is most desirable and the frequency with which it should be renewed. Brown-Lipe recommends extra heavy fluid oil filling the gearbox only to the top of the countershaft, stating that this will give sufficient lubrication for any emergency and will avoid leakage around the various joints of the gearbox, a condition which the company

states is almost invariably caused by high pressure due to heat expansion of the lubricant. This concern fits all its gearboxes with breather tubes to take care of this phase of the situation. Warner prefers transmission oils, stating that greases do not flow into the smaller spaces properly. This company has found that it secures best results with the oil depth about ½ in. from the top of the countershaft. Northway favors a fairly heavy grade of engine lubricating oil at a level about the center of the lower shaft. Manufacturers who do not agree with any of these views usually do not concern themselves with the matter, leaving the car builder to recommend whatever lubrication he considers best adapted for the gearset in its capacity as a unit of the chassis he is producing. On most of the modern gearsets oil level plugs are provided to determine the correct depth of the lubricant. Grant-Lees has changed from the gland stuffing box type to the spiral lead end plate, having found the latter superior in that it keeps the oil in the gearbox and requires no attention. The Cotta Transmission Co. recommends a medium light grease of a depth to cover both shafts of the gearset.

The majority of gearset makers agree that the lubricant, irrespective of the sort used, should be renewed every 5000 miles. Some, one of whom is Grant-Lees, consider that the lubricant should be examined once every 2 months with average driving, the frequency of renewing the lubricant depending upon how much the car is driven on its lower gears. Others, of whom Warner is an example, have secured best results when the lubricant is changed every 1200 to 1500 miles of car travel. When this lubricant is changed it is generally approved practice to drain out the lubricant thoroughly and then wash out the interior of the gearbox with kerosene oil.

Electric Gearshift Makes Progress

The use of electrically operated gearsets has made some progress during the past year, equipment of this type having been adopted as standard by a number of automobile companies, while several others have been conducting experiments with this method of control with a view to announcing it as standard or optional equipment about the first of the year.

For the future, little can be predicted as to probable alterations in the gearset and clutch design. It would seem most likely that present constructions will continue for some time without any appreciable change in their basic principles, the only alterations being in the way of refinements and simplification of parts or assembly and hence naturally of a minor nature. This state of affairs bids fair to endure until some radical developments in automobile construction call for correspondingly radical modification of gearsets and clutches as means for the transmission of power from engine to wheels.

Clutch Design Greatly Improved

Simplification Due to Elimination of Adjustments, Weight, Etc.—Disk Type Increasingly Popular—Fewer Plates Permit Increase of Pedal Leverage

By J. Edward Schipper

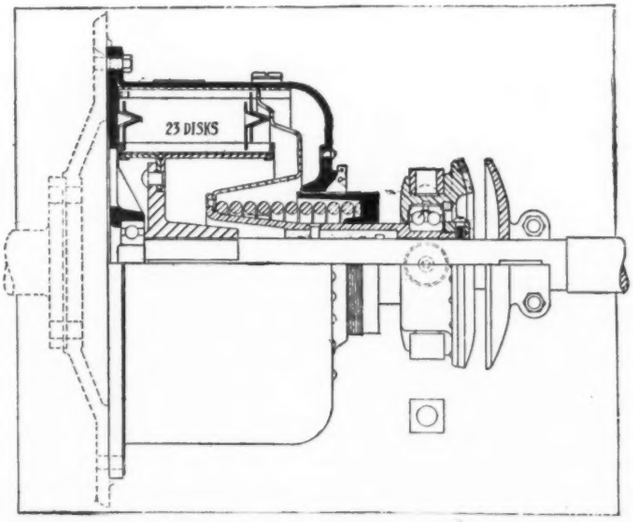
THE question of clutch design as shown by those clutch makers who supply to the automobile trade in general shows improvements from year to year. Elimination of adjustments and weight is the summation of clutch tendency in design as denoted by the changes during the past year. Broadly there is a tendency among the automobile manufacturers toward the employment of the disk rather than the cone. In the disk design itself there is a leaning toward the use of fewer disks.

If the figures on clutch weight per horsepower transmitted could be plotted in a curve they would show that this has been dropping, year by year. The aluminum cone for the cone type was one of the earlier indications of this and although the tendency is a little toward the pressed metal cone, the light-weight characteristic remains.

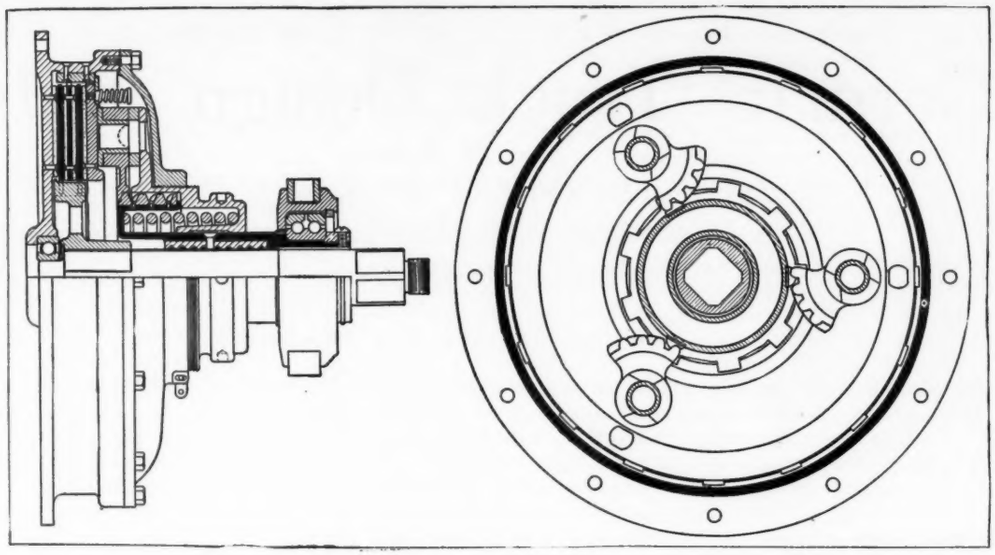
Lubrication Generally Automatic

Mechanically the clutch is a much simpler proposition now than heretofore. The adjustment points are fewer and the lubrication is generally automatic so that a clutch may go 50,000 miles without attention. Clutch wear is taken up automatically inside the assembly and on some of the prominent makes the only adjustment provided is that to prevent the pedal from striking the floorboard.

Another line of improvement is in the pedal linkage which permits clutch disengaged with much less effort. The leverage is increased in some instances directly on the pedal, but in general the reason for improvement is that the fewer plates on the disk clutch require less motion on the part of



Hele-Shaw standard No. 6 clutch with twenty-three disks for 40 hp. at 1000 r.p.m. This clutch is very widely used, being designed for flexibility and ease of operation in conjunction with positive engagement, insuring against loss of power in this unit of the transmission system. The case is of pressed steel, the core of steel and the presser is steel and malleable iron. Phosphor bronze is used for bushing and for the outer disk, the inner disk being sheet steel. The brake is of malleable iron with an asbestos lining

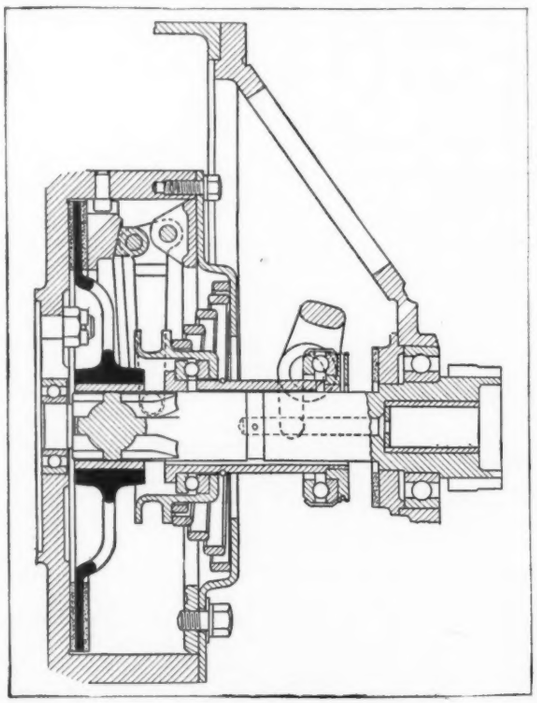


Hilliard Clutch & Machinery Co. disk clutch assembly with double annular bearing and inclosed spring. The forward end of the clutch shaft is supported within the flywheel disk by an annular ball bearing

the clutch linkage and hence it is possible to make this smaller travel up in increased pedal leverage.

The increased engine speed and greater reduction at the rear axle have influenced clutch design. It is naturally much more difficult to transmit in a given weight clutch, 40 hp. at 1200 r.p.m. than it is at 2500 r.p.m., the question being one of torque. With the greater rotative speeds of the clutch members, the torque transmitted at a given speed falls off and hence this will aid somewhat in clutch design, although factors of safety have increased rather than decreased, due to the use of better materials.

Lightness in clutch rotating parts is necessary if clashing of the gears is to be prevented. The clutch brake is an aid but independent of the clutch brake, makers have reduced the inertia and spinning tendency of the clutch members by a decrease in weight.



Borg & Beck clutch assembly showing three-plate clutch type with conical engagement spring and ball thrusts. The use of ball bearings is conspicuous in this clutch assembly

Ease of engagement is looked after in different ways in disk clutches, but with the cone, it is common practice to use about six bowshaped springs beneath the surface of the leather. On the clutch made by the Warner Gear company these are adjustable by means of screws on the inner side of the cone. There is no other adjustment.

With a ball-type thrust of two hardened and ground races of the best quality of material, and with the balls carried in a retainer that not only retains the balls but also a sufficient quantity of lubricant to take care of them readily, there is no need for an adjustment, as such an installation will serve indefinitely unless dirt or foreign matter enters. In that case, even an adjustment would not serve, as a replacement would have to be made anyway.

Cone clutch angles are about the same as formerly, running about 12 or 13 deg. Nothing has supplanted good quality leather as a facing for the cone. With the disk clutch the use of woven asbestos fabric quite similar to that used in brake installations is considered best by the majority. The leather is always riveted on with the rivets countersunk beneath the surface of the leather to secure against metal to metal engagement.

Engaged Area Decreasing

While with the disk clutch the total area of surface engaged is growing smaller, due to the falling off of the disk-in-oil type and the gaining of the dry-plate type, the trend is going the other way on the cone clutches. With the cone the surface area is less than the area given by the disk type, the difference being that it is more effective because applied at a greater distance from the axial center of rotation. The amount of clutch area in consideration for the work to be done, however, compares very favorably with the similar problem that comes up in brake design.

The Hilliard Clutch & Machinery Co. makes a feature of the point that no clutch brake is used. The spinning of the rotating members is prevented by simply having a combination of a quick-acting release which does not permit of a drag while releasing and further by having the parts so light, that the rotation does not continue long.

On the clutch made by Fuller & Sons Mfg. Co. the development has been typical in that all adjustments are eliminated. The clutch requires no attention except that the throwout bearing must be oiled occasionally. The only adjustment on the clutch is the adjustment which prevents the pedal from striking the floorboard. The clutch brake has been eliminated on all the Fuller clutches except the oil type, and in its place a quick releasing scheme with light parts has been substituted.

German Truck Design Is Improved

Commercial Vehicles Are Stronger But Lighter, Due to War Developments—Electric Types Gain—New Batteries Features—Gasoline the Fuel of the Army

By E. A. Langdon

WHILE passenger car design has made comparatively little progress in Germany since the outbreak of the war, motor truck construction has been greatly improved and the scope of both gasoline and electric commercial vehicles has been considerably widened. Strength and light weight are the features which most impress one in inspecting these machines, both being due to the need for economy in both construction and operation and to the use of lighter materials such as steel-reinforced wood frames, hydraulic spring systems instead of steel springs and other similar innovations.

Many Electric Trucks Used

The number of electric trucks has been greatly augmented, the ever-present necessity for economy being partially responsible for their popularity since current is unusually inexpensive, due to the abundance of coal Germany is mining from the northern section of France occupied by its armies. Highly efficient batteries of a new type have been developed because the demand for lead by the munitions factories rendered lead cells out of the question and the scarcity of nickel in Germany prevents the extensive use of the nickel-iron type. Gas batteries, in which slightly acid water is decomposed by the current on entering into oxygen and hydrogen, are said to be used in large numbers as reserve sources of current in stationary plants. When the oxygen and hydrogen is released from compression in the cathode and anode spaces through reduction valves they again combine as water, liberating current to the amount originally absorbed in the process of decomposition.

Gasoline Fuel for Army Cars

While gas obtained from distilled coal constitutes a large percentage of the automobile fuel used in the interior of the German Empire, gasoline is used almost entirely in military operations. The Germans consider their gasoline supply, at least sufficient for the needs of the army, to be secure for an indefinite period.

Material for spark plug terminals for a long time proved a stumbling block to German automobile engineers, as platinum is unobtainable. A new alloy has been developed, however, and is claimed to give very satisfactory results, although it has not yet had an opportunity to prove its serviceability in general use.

A Glass Cylinder Head

A number of interesting experiments have been made with new and unusual materials for automobile construction. One of the most novel of these was a cylinder head made of what looked like glass reinforced with wire fitted with valve seats of nickel steel. The material turned out to be an oxide of silica molded on a steel wire skeleton.

Wooden wheels are almost universally used on German cars and trucks, as the metal formerly employed in steel and wire types is now required for war purposes.

There are not many instances which illustrate so well the change industrial Germany has undergone during the last 2 years as the automobile situation in the interior of the empire. For life in general does not differ so very much from that in a normally operating country; the number of able-bodied men in the streets is considerably above what outsiders would imagine, and the people are fully as busy as in times of peace.

Few Passenger Cars on Streets

However, the moment one leaves a home, store or factory and enters the street, the abnormal condition of German existence becomes evident. For there is an absurdly small number of passenger automobiles, and what there are consist of old, invalid hacks, vehicles which nobody would think of using in normal times; and at the same time there is a very great number of commercial vehicles, but these, too, are of an entirely different type from what was seen before the outbreak of the war. Let us consider both of these phenomena.

All Good Cars Drafted

Passenger automobiles, like all things which are not a matter of absolute necessity, have become utterly negligible in German eyes—principally because they had to. The military operations at the front could easily employ all passenger automobiles German and Austrian factories could turn out, and more; and the absolute subjection of individual interests to those of the State has resulted in the drafting into service of every car which is at least 40 per cent efficient. These cars are used for the extremely rough work which frontal operations necessitate; and the result is that every part of the car suffers, though not in equal degree. Some of these machines, as has been described in a former article, are overhauled in field automobile hospitals, of which there are several at each front, and by this expedient the life of each car is increased, on an average, by 100 to 200 per cent. But finally the time arrives when the automobile can no longer be kept serviceable in this fashion, and when, in times of peace, it would be consigned without mercy to the junk heap. In war, however, the junk heap is merely the assorting department for the materials needed by the divers factories of the empire. Hence, these unserviceable automobiles are taken to one of the enormous plants handling this work of assorting waste materials—there are, in all, five such plants in Germany and Austria, employing in all close to 80,000 hands—where they are taken apart and segregated.

Some Parts Still Useful

Some parts of these disassembled cars with slight chemical treatment, can be used over in assembled cars which are continually being built for service at the front; other parts are put aside to be melted and entirely refashioned; whereas a minimum quantity of parts is always placed aside and used in the makeup of the passenger vehicles, police and ambulance wagons which are absolutely necessary in the interior. It stands to reason that these latter classes of vehicles are of a lamentable kind, most of the time entirely devoid of any

design, and built rather along lines of expediency than of harmony or looks.

Progress in Truck Design

As for trucks, the difference between the importance given to them and that allowed for pleasure cars is most striking. For commercial vehicles are not only, without exception, harmoniously and suitably designed, but every one gives a decided impression of strength, coupled with light weight. The latter point is the result of two conditions; first, the necessity of economizing all sources of energy; second, the use of lighter materials than were the vogue before the war. These lighter materials include spruce frames stayed by steel braces, as well as combinations with other principles of construction. It is surprising to an observer not accustomed to these types of vehicles what strength can be obtained by these means, if proper weight distribution is had by suitably designed braces and stays and if the suspension is ample. German engineers are not tempted to false economy in this latter regard.

Hydraulic Spring Systems

Hydraulic spring systems, often including a set of different-sized cylinders arranged in suitable series to take gradually varying shocks, have become very common during the last 2 years. Some of these hydraulic shock absorbers, which, by the way, have almost completely taken the place of steel springs on commercial vehicles, are not working on the principle of internal friction in the liquid or between the liquid and arduous passages, but are so constructed as to utilize the resistance of the container against an outward radial stress, whereby advantage is taken of the full tensile strength of the metal.

Electric Current Cheap

In regard to economy of energy—the word "fuel" being purposely avoided in this instance—the number of electric trucks has increased enormously ever since the outbreak of the war, and is still increasing, for all purposes where automobiles are used on good roads; and, generally speaking, all roads in the industrial sections of the empire *are* good. Electricity is one of those many commodities the productions of which is now under governmental supervision, but current is surprisingly cheap; the explanation being, very likely, that the Germans are deriving great quantities of coal from the mines in the territory held in France. In many cases, where numerous trucks travel along fixed lines of transportation, as between industrial centers of moderate distance—railroads being used chiefly for purely military passenger and freight transports—the vehicles are propelled by single or double electric motors in place on the rear axles, current being drawn from overhead conduits by means of a trolley. Where the importance of a route is not great enough to justify the construction of such a conduit-wire line—and it is remarkable with what degree of "scientific management" and statistical study the Germans determine whether a route is of greater or lesser national importance—the trucks are fitted with batteries. Very little can be learned just now about the construction of these batteries; but it is certain that almost all are other than lead cells, though it is not very likely that they are of the nickel-iron type, as nickel is quite rare in Germany at the present time.

New Type of Battery

Apropos of these conditions, it is interesting to note that a great many lead batteries which served as reserve sources of current in stationary plants have been supplanted by an entirely different type of battery, as lead is needed in the making of ammunition. These novel batteries are said, in a number of cases, to be of the "gas" type, wherein water with a slight acid percentage is decomposed by the current upon entering, is stored in cathode and anode spaces in form of oxygen and hydrogen, being compressed there by suitably designed mechanism, and when the battery is drawn upon, the gases leave from their chambers through reduction valves in proper proportions and again combine to water, freeing the amount of electricity first absorbed in the decomposition of the liquid.

Poles Faced with Platinum Powder

The poles of this battery are faced with "Platinmohr," black amorphous powder of platinum, which is at once a good conductor of electricity and a good catalyzing agent, being used to a great extent in the making of sulphuric acid, one of Germany's most important industries. The use of this material for batteries shows how the industries of the empire have become linked and, as it were, reshaped along lines of "interchangeability of parts." For the sulphuric-acid industry has been drawn upon for much of the platinum used there and is now using in place of the platinum method, a new kind of "contact process," as they call it. This is only another illustration of how, so to speak, not a molecule of matter is lost within the empire, no matter how great a quantity is shot and burned away at the battlefield.

Soldiers Understand Gasoline Cars

The fuel of the automobiles used at the front consists almost exclusively of gasoline, and the reason for this is that hundreds of thousands of soldiers are well familiar with the operation of gasoline engine and average automobile, as well as with the chief points of its construction; consequently the risk of the personal equation is smaller in the case of the average gasoline car than if any other type of automobile were used. Moreover, the Austrian oil fields in Poland, the wells of the occupied Russian territory and what oil and oil products were imported from Rumania heretofore are ample for the requirements of the field automobiles, and the more perfect organization developed during the war has quite overcome the need of using industrial alcohol, or benzol, for that matter. At the time of this writing, it is a few days since Rumania has entered the war, and according to the military experts who predicted with fair precision the development of the Serbian campaign under General Mackensen, the Germans expect to be in secure possession of the Rumanian oil fields within less than 8 weeks. This, of course, is problematical, but the fact is that even if the Rumanian supplies of gasoline to Germany be cut off, the other two sources mentioned would suffice for the needs of the army—and navy, for the latter now includes a number of vessels, both of the submarine and light cruiser type, using kerosene or gasoline for propulsion.

Material for Plug Terminals

One of the difficulties experienced by German engineers lies in the terminals of spark plugs. Platinum, used solid or as a coat, is absolutely unobtainable, as Russia, the chief former source of supply, is now of course shut off, save for small quantities which find their way into Germany via Sweden, or which were taken from craft captured in the Baltic. The Germans have been working on an "Ersatz" (substitute) for some time, and while it is not used generally as yet, engineers claim to obtain surprisingly fair results therefrom. They are, of course, very secretive about the matter; but from what the writer could learn, in a vague manner, here and there, it would seem that the substitute is an alloy of gold and a metal of the "radium" group, very likely uranium. Some experiments made with a selenium compound or rather alloy are also said to have been fairly satisfactory, except for the variable conductivity of this element which changes with the degree of light or radiation to which it is exposed; which fact caused fluctuations and disturbances throughout the ignition system of the car and

led to the abandoning of the idea as hardly practicable.

One peculiar innovation was witnessed by me some time ago when visiting the Western front. It was a cylinder head made of a material which resembled wire-reinforced glass, and, it was stated, was indeed of a similar composition, namely, an oxide of silica made in one of the chemical factories along the Main and reinforced by a skeleton of steel wire. The valve seats, made of nickel steel, are put in place when the head is being made and still at a very high temperature. These cylinder heads are, except for the connecting ways to the manifolds, without jackets; small wire points protrude from the inner wire skeleton and are cooled by the stream of air directed upward by the inclined fan.

Wood Wheels Employed

While the French and English armies use thousands of cars fitted with wire wheels, the Germans have practically departed from their use, principally because the empire's enormous lumber reserves permit of easy and cheap wholesale production of good wooden wheels, while every metal is comparatively scarce and economy is necessary. The metal which has been less subject to this rule than any other seems to be aluminum, for which new uses are found every day and which is produced very cheaply by the electric furnace process.

Thermite Welding Process Important

The aluminum powder, or Thermite, process of welding has also become of tremendous importance, and the equipment for this process forms part of every "Automobil-Hilfe-Automobil," that is, an automobile containing the repairshop equipment needed for quick repairs of automobiles and motor trucks. These traveling "Automobillazaretts" contain a simple but complete outfit for welding, a lathe, punch, a small drop forge, and a full set of minor tools, so that almost any repair can be made anywhere and at any time, the necessary power being furnished by the motor of the repair wagon. These traveling repairshops are, morever, fitted with wireless telephones and small generators geared to their motors, so that they can easily and immediately get into communication with the nearest motor department, "Kraftwagenfluegel," of the army to which they belong. The crew consists of three men, each one an expert driver and mechanic and electrician.

Young Drivers Well Trained

Every kind of labor which is connected with the driving and repairing of automobiles is plentifully supplied to the army. The boys between 17 and 19 years of age are trained in the school, with a view to preparing them for military service when they reach the full age, and from among those showing mechanical ability and inclination the future automobile operators are picked. These are trained by experts, not only in driving, but in repairing every conceivable kind of accident or damage, as well as first aid to the injured; so that in all likelihood Germany will possess, when the war is over, the greatest number of automobile expert drivers among all countries in Europe, which will make these young men vastly superior in earning power and serviceableness to what they would have been without this training.

Automobile Corps of High Class

Wherever possible, the automobile drivers are chosen from the soldiers knowing the language of the enemy the particular army is in contact with, so that if by accident they come into possession of military information they are in a position to report it with the greatest possible speed to their superiors. A stranger would be most surprised to note the high percentage of intellectual men, engineers as well as students of medicine, languages and theology, among the contingent of automobiles attached to the German army.

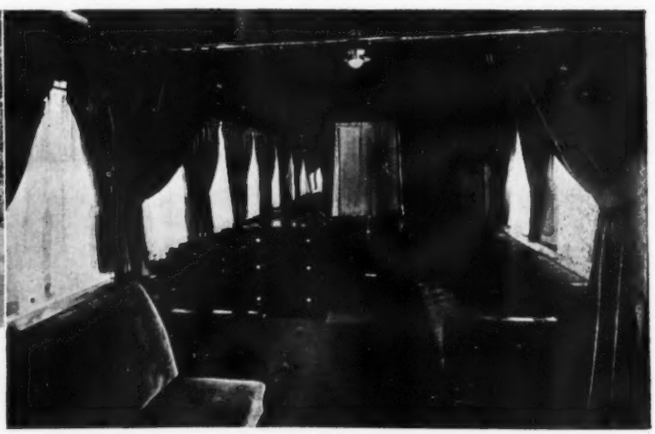
Spring Starters Widely Used

While the construction of automobiles, as heretofore mentioned, has become much simpler, no desirable accessories are spared to make operation efficient. For instance, spring types of self-starters are almost universally used where hand cranking is not retained; and speedometer, thermometer and barometer form part of every automobile equipment; the same thing may be said to hold true of the "trench periscope," a vertical tube with inclined mirrors at each end, and about 6 ft. long; a small heliograph, detailed map, compass, etc.

A Big Tractor Market

There is no doubt that when the war will be over, the automobile industry of Germany will emerge as something reborn and as far advanced over what it was before July 31, 1914, as it was at the latter date over 1900, both because of the improvements and developments made during the war, and on account of the practical annihilation of most draft animals, except what specimens were reserved for stock breeding. But there is little likelihood of the German peasant ever turning to horses again for his agricultural work. What he will look for, will be a moderately priced, highly reliable, simple, efficient automobile, which can be rapidly transformed into a tractor. For such a machine, Germany will offer a wonderful market, because, in spite of the empire's enormous industry, agriculture is still one of the two greatest, if not the greatest method of occupation of the German people.

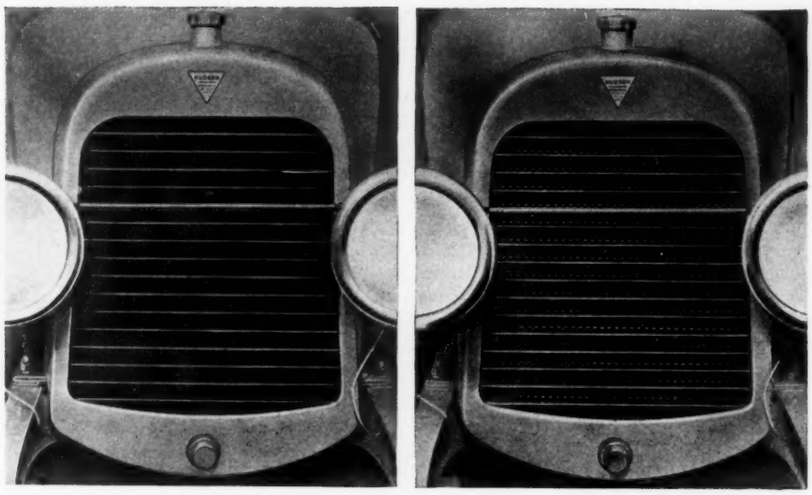
Touring Land Yacht on a Moreland Chassis



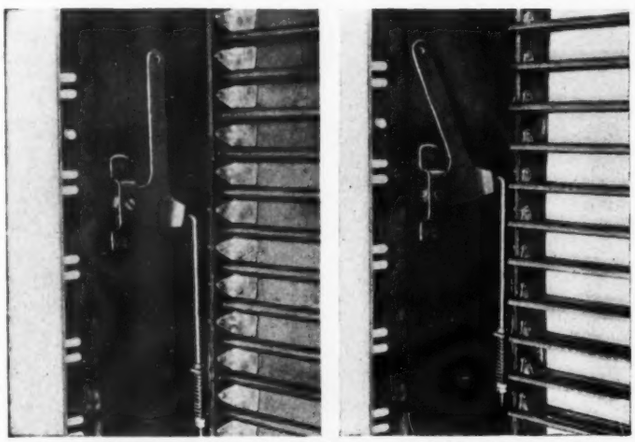
Touring palace built for Mrs. Ruth Kohler, Fresno, Cal., by Moreland Motor Truck Co., Los Angeles. Interior shows mahogany woodwork, carpeted floor, dome lights, curtains dividing compartments and davenports making full size beds

Hudson Fits Dash Radiator Control

Illustrating operation of the Hudson radiator shutter control by means of pull rod from the dash



At the left is a view of the Hudson radiator with the shutter closed and at the right with the shutter partly open



Left—Closed position of shutter link. Right—Open position

TO remove the necessity for using padded covers, etc., on the radiators of Hudson cars, the company has brought out a device which acts as a radiator shutter and which is being listed as special equipment. The new device is operated from the dash by the driver and permits him, by means of a simple plunger, to govern the amount of air that comes in contact with the radiating surface, and hence puts the temperature of the cooling fluid under his control.

The device acts very much as a shutter, with a series of vanes which open and close in accordance with the movement of the controlling device on the dash. In summer the mechanism need not be detached, as it does not cut down materially the area of the radiator when it is full open, so that in warm weather it is simply left untouched.

In order that the device will be complete, it is necessary for the driver to know the temperature of the cooling water accurately enough to determine whether the shutter is open or closed to the correct degree. This part of the equipment is provided by a Boyce Moto-Meter mounted in its customary position on the radiator cap.

The device is valuable in warming the car in very cold weather, as the air can be entirely shut off from the radiator until the water temperature reaches its efficient temperature, which in the case of the Hudson is stated to be 130 deg. Fahr. The shutter vanes can then be opened to the desired amount by simply operating the pull-rod on the dash.

From a maintenance standpoint the device is simple, as there is nothing to it except the shutter and the rod and bell-crank operating mechanism. There is no need for any adjustments, and none is provided. The installation is simple, and is made possible by using a longer radiator shell which not only houses the radiator, but also the shutter. It can be fitted to all Super-six Hudsons, the cost of installation being $25, with Moto-Meter complete. If the owner has already a Moto-Meter the shutter assembly costs only $15.

The accompanying illustrations give a very clear idea of the construction and operation of the device, the neat and simple pull rod mounting on the dash being both conveniently situated and by no means detrimental to the appearance of the instrument board. The front views of the radiator showing the shutter both closed and in a partly open position make it evident that appearance has not suffered in this direction; in fact, if any comment is to be made on the matter, it may be said that the new design is more attractive than the old and far less likely to become clogged with dust and debris from the road.

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Goodyear Employees Paid for Ideas

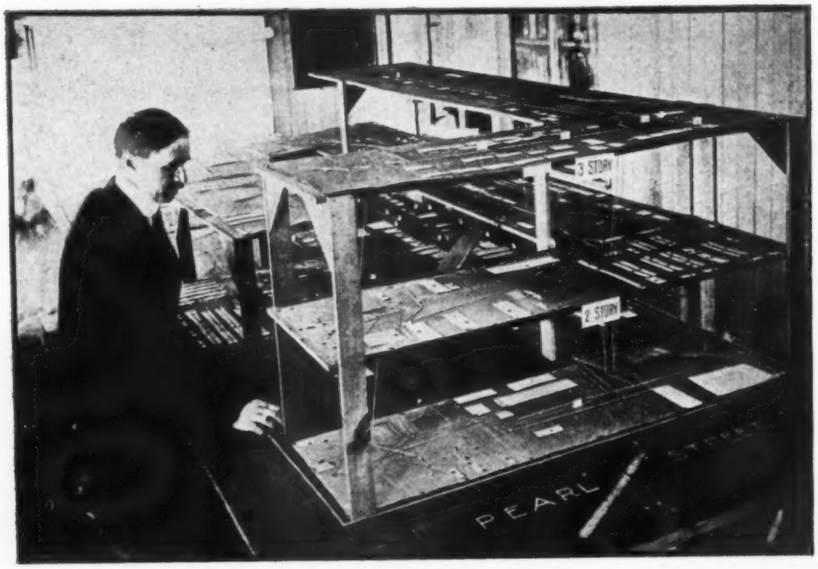
ONE of the most popular operative features at the plant of The Goodyear Tire & Rubber Co., Akron, Ohio, is the suggestion system, which enables employees to capitalize their ideas for improving machinery, conditions, methods and product.

The workmen who make Goodyear products are given every opportunity to advance their ideas, and all suggestions adopted are well paid for. Interest in the system is well sustained, and thousands of dollars have been paid to employees for their ideas.

The suggestion box method is used, with boxes placed throughout the plant in convenient places. Employees are asked to put their ideas in writing and deposit them in the suggestion box. The suggestions are gathered each day and referred to the proper persons for consideration. All are carefully gone over, however inconsequential they may seem.

Motion Study as a Production Factor

Examining the Worker's Motions To Ascertain Causes for Inefficiency—Frank B. Gilbreth's Methods and Instruments



Model of factory as laid out before plans for analysis are made to determine lost motion

DOES the average worker become fatigued unnecessarily? Is the production of the usual factory below its capacity? Are many factories increasing the number of men and the amount of floorspace needlessly? Is it possible for the average workman to be raised to a higher level of efficiency, raising his productive abilities, yet lowering his fatigue? Do wasted motion and wasted effort cause a vast loss of wasted time to the majority of manufacturers? These interesting and vitally important questions form a great part in the study of motion that Frank B. Gilbreth, efficiency engineer of Providence, R. I., has made a life problem and to which he introduced many novel and consequential theories and devices.

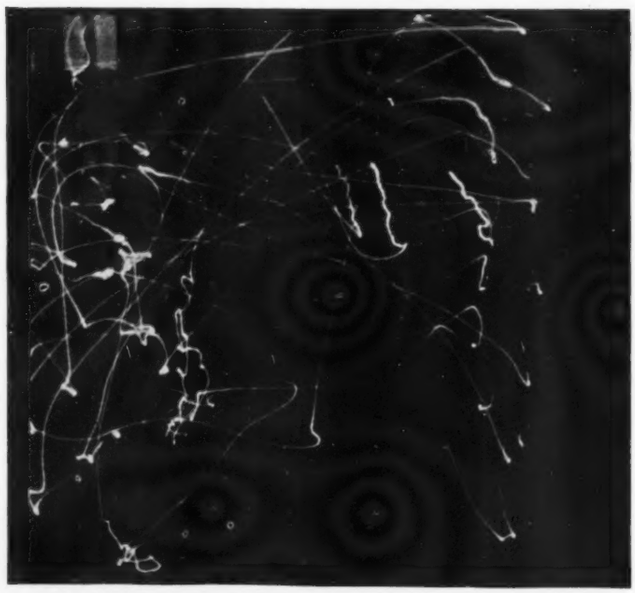
Wasted Energy

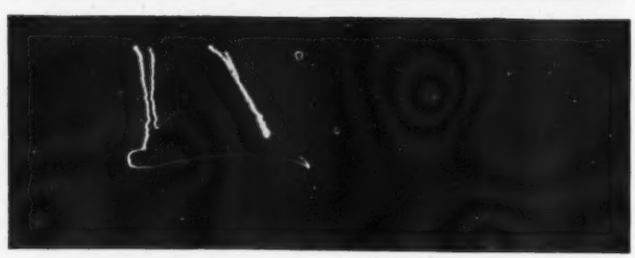
Thirty years ago Mr. Gilbreth was an apprentice bricklayer. He asked the foreman to show him the proper way to lay bricks. Though a master mason, the foreman had many methods. One was for hurried labor, another for times when speed was not required and so forth. The boy studied the work thoroughly. He saw that many of the men, like the foreman, never laid the bricks with the same motions for two jobs. He became convinced that a very valuable study would be found in an attempt to determine the least number of motions for brick laying that would at the same time have the effect of not tiring the worker. Since that time he has devoted himself to efficiency, first as a student, and now as a consulting engineer confining his time to the discovery of waste motion in various factories and industries.

He investigates factories, makes improvements, omits stages of manufacture and substitutes skilled labor for unskilled wherever possible. In a handkerchief factory he noticed one girl whose work, consisting of folding handkerchiefs, slackened perceptibly each afternoon until it fell far below the work of the others. Investigation revealed that the chair upon which the girl sat had worn, that the front legs were so low that the girl was forced to use her arms at so high an angle that they tired and consequently became less efficient. A carpenter repaired the chair and a few days sufficed to show the girl working with all the speed of her companions in the shop.

Motion Study a Science

Mr. Gilbreth defines his work as motion study and says: "Motion study is the science of determining methods of least waste and my work is the installation of laboratories for large concerns and the creation of examining processes to determine how the work can be done with the least number of movements. The discovery of such a method allows the manufacturer to secure the greatest possible output, to pay his employees more money and to make more money for himself." He believes that





Above—Motions of a worker in loading sixteen boxes before motion study methods were adopted. Below—The same operation when efficient methods of concentrated motion are used

Right—Foremen of a factory being instructed in the wrong and right methods of operation by means of moving picture application of motion study

Below—Cross section method of studying motion to eliminate fatigue, the worker standing before a background of checks, so that each motion can be recorded according to its appearance before the squares

Lamp used with cinematograph to display the motions of the worker. Lamps are attached to fingers, knees or forehead

Hand of a bricklayer photographed with lamp attached and showing the operation of laying bricks when motion study methods minimize the expenditure of effort

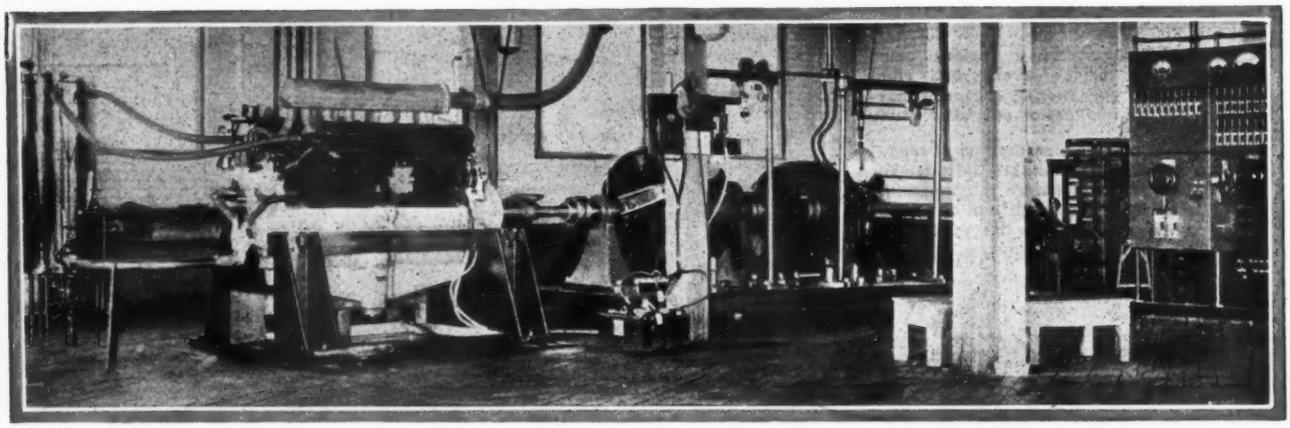
the only way to study an industry or trade is to learn the fundamental motions and to do these rapidly even though the speed, at first, affects the quality as he finds that the elimination of unnecessary motion is more important than spending time learning the process by slow and elaborate methods. The slow way, he states, requires far different motions from the quickest way and as a consequence, the worker is forced to learn two methods before he becomes proficient.

To ascertain the motions of workers, Mr. Gilbreth has utilized and invented many instruments. He commenced his work with a stop watch but found it too slow and often inaccurate and has combined with it the cinematograph, which is able to photograph every motion and preserve it and, in addition, when used with a special clock, allows him to time each movement. The clock is an appliance that makes a complete revolution every 3 sec. and measures to the millionth part of an hour. It has a watch attachment to check its accuracy. Temperature and humidity are always taken into consideration. A penetrating screen is used on which the proper motions are marked and before which a photograph of the worker is taken so that his movements can be compared with the correct ones. Thus, by means of the moving pictures and the screen, the worker not only sees himself as others see him but also is able to witness many movements not ordinarily seen by the eye and is shown all of the wasted effort he has used.

Lights Show Motions

To facilitate the camera, lights, similar to those used by physicians for examination of the throat and operated by a make and break apparatus, are used. They are placed upon the hands, fingers, knees and foreheads of workers and photographs taken reveal each movement of the various lamps. The photography is consequently utilized to determine time when compared with the clock and the flashing lamps, and to discover the width, length and breadth of the motion of the worker. Complete assembly operations are often photographed and each movement required by the different workers is displayed and timed and measured. The work of the best men can thus be shown on a slow moving cinematograph machine so that it can be followed by the unskilled and adopted by them.

Another instrument used is a background of checks against which the worker stands and moves so that each motion can be recorded according to its appearance before the squares. Utilizing this system, Mr. Gilbreth checked a man loading boxes. He classified his motions by sixteen acts under the headings of search, find, select, grasp, position, assemble, use, disassemble, inspect, loaded, position for next operation, relieve load, transport empty, wait unavoidable, wait avoidable and rest. The results of these checks are shown in the two illustrations at the bottom of the opposite page.



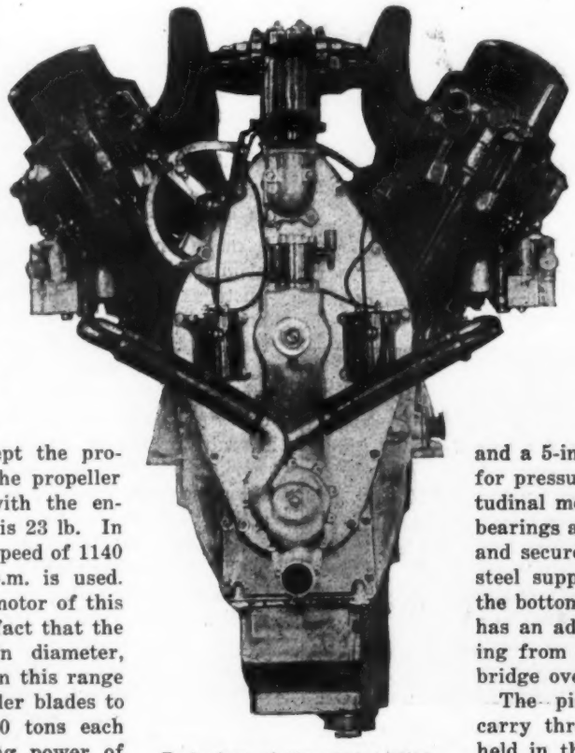
Knox twelve-cylinder aviation engine designed by F. H. Trego undergoing tests with a Sprague dynamometer at the Knox laboratory

Knox Aviation Twelve Tested

300-Hp. Engine Designed by F. H. Trego Has 4 3/4 by 7 In. Bore and Stroke—8-Hr. Run Made

SPRINGFIELD, Mass. Nov. 15—One of the largest V-type aviation engines ever built in this country has just been put through a series of tests in the laboratory of the Knox Motors Co. here by Frank H. Trego, chief engineer and designer of the motor. The engine is intended for high-power aviation work and is rated at 300 hp. It has been designed to meet the severest aeroplane service in Europe, and since work was started on it a year ago representatives of foreign concerns have not only been watching its development but keeping very closely in touch with all engineering details. Engineer Trego has been working on the matter consistently for nearly a year and has now a power plant capable of withstanding the severity of 8-hr. tests.

The engine, a twelve-cylinder, V-type valve-in-the-head design, has the aluminum cylinder blocks formed in groups of three, and the two sets of threes mounted at 60 deg. to each other. The bore and stroke of 4¾ and 7 give a piston displacement of 1488.53 cu. in. With this piston displacement the weight complete with starting and lighting motor and generator, ignition equipment, exhaust pipes, and tachometer is 1400 lb. This weight includes everything except the propeller hub, which is a part of the propeller assembly, although furnished with the engine. The propeller hub weight is 23 lb. In the preliminary test a propeller speed of 1140 and a motor speed of 1600 r.p.m. is used. Some conception of the work a motor of this type has to do is shown by the fact that the four-bladed propeller, 14 ft. in diameter, turns at 1100 to 1200 r. p. m. In this range of speed the effort of the propeller blades to fly off the hub approximates 20 tons each and the propeller has a pushing power of 2000 lb., according to Engineer Trego.



End view of the new twelve-cylinder Knox aviation engine

The cylinder blocks are aluminum castings open at each end and in these are pressed ⅛-in. cast iron liners, these liners having a flange on the lower end are pressed into the bottom. Although the cylinders are cast in blocks of three, the heads are cast in blocks of six and are of aluminum alloy with cast iron valve seats, cast integrally with head casting. The head for each of the cylinders is secured by sixteen nickel steel studs passing through the head. The four valves in each cylinder are carried in the head and the water-jacketing so arranged as to surround each valve seat. The water-jacketing of the cylinder blocks is so carried out as to extend below the bottom of the stroke and to allow ½-in. water space between adjacent cylinders. In addition each cylinder head has an aluminum cover which entirely conceals and protects all of the valve mechanisms.

The rotating and reciprocating parts of the engine have been designed with the thought of enduring the heaviest service imposed on an aviation motor. The crankshaft, a chrome nickel steel forging, is 3 in. in diameter at its three bearings as well as at the crankpins. The shaft has a total bearing length of 13 in., 4 in. at the front and center, and a 5-in. bearing at the rear. It is drilled for pressure lubrication and held from longitudinal movement by a center bearing. The bearings are babbitt, backed by a bronze shell and secured by aluminum caps backed up by steel supporting plates ⅝ in. thick all over the bottom of the bearing. The rear bearing has an additional supporting steel bar hanging from two bolts which pass down from a bridge over the top of the crankcase.

The pistons of special aluminum alloy carry three rings and have the piston pin held in the upper end of the connecting-rod with its bearing in the piston where the

aluminum alloy serves as a bearing metal.

Connecting-rods are drop forgings with a bearing cap at the lower end held by two bolts and with cap and rod locked together by tongue-and-groove formation to prevent twisting. The rods are side by side on each crank throw.

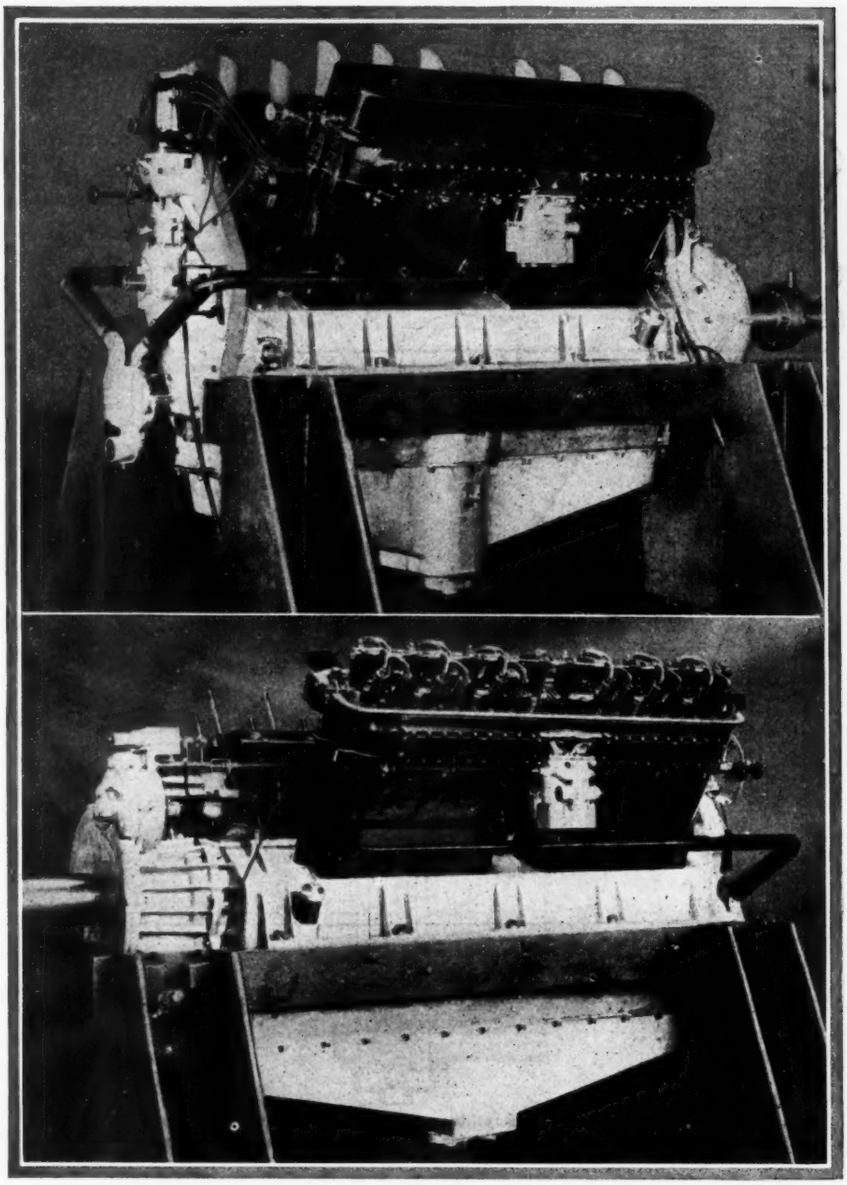
The crankcase is an aluminum alloy formed in one piece and extending 7 in. below the center lines of crankshaft in order to give a barrel section for strength. The lower half is a one-piece aluminum casting bolting to the upper half and not containing any of the motor mechanism.

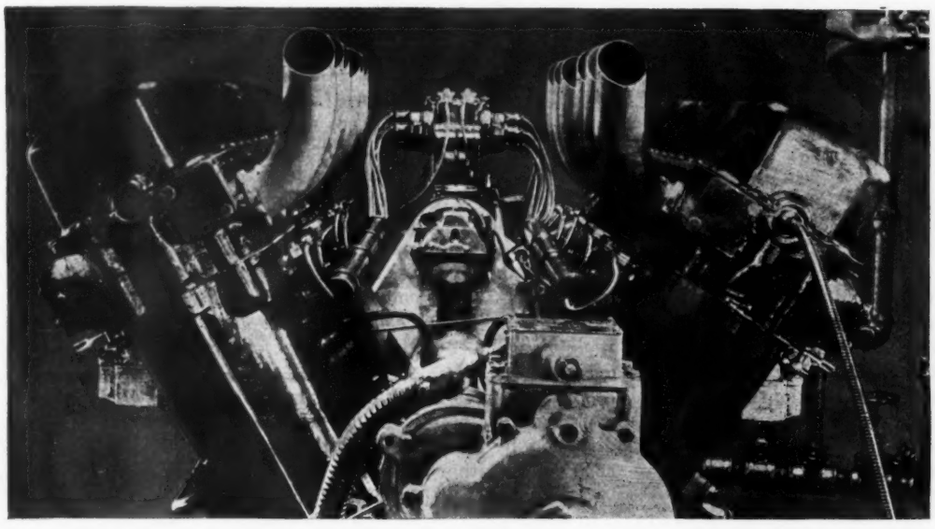
For attachment into the framework of the aeroplane supporting legs are not used but support is through a shelf extending the full length of the crankcase on each side and on which the motor rests. Five bolts anchor each shelf into the framework of the aeroplane and to add rigidity a rib is cast on each side of each bolt. With this support the motor is kept very narrow at this point and rests in a frame 15 in. wide inside and with bolt centers 17 in. apart.

Valves at an Angle

The valve mechanism operating four valves in each cylinder is operated through a camshaft lying along the head of each cylinder block, thus mounting the valves at a slight angle to the cylinder bore. The camshaft and rocker arms are supported in the head, the camshaft having eight bearings. The arc-shaped rocker arms are supported above it as the end section shows. Forced feed lubrication with necessary drainage back to the crankcase is at the center of the motor when the motor is in normal condition and at each end when the motor tips up or down.

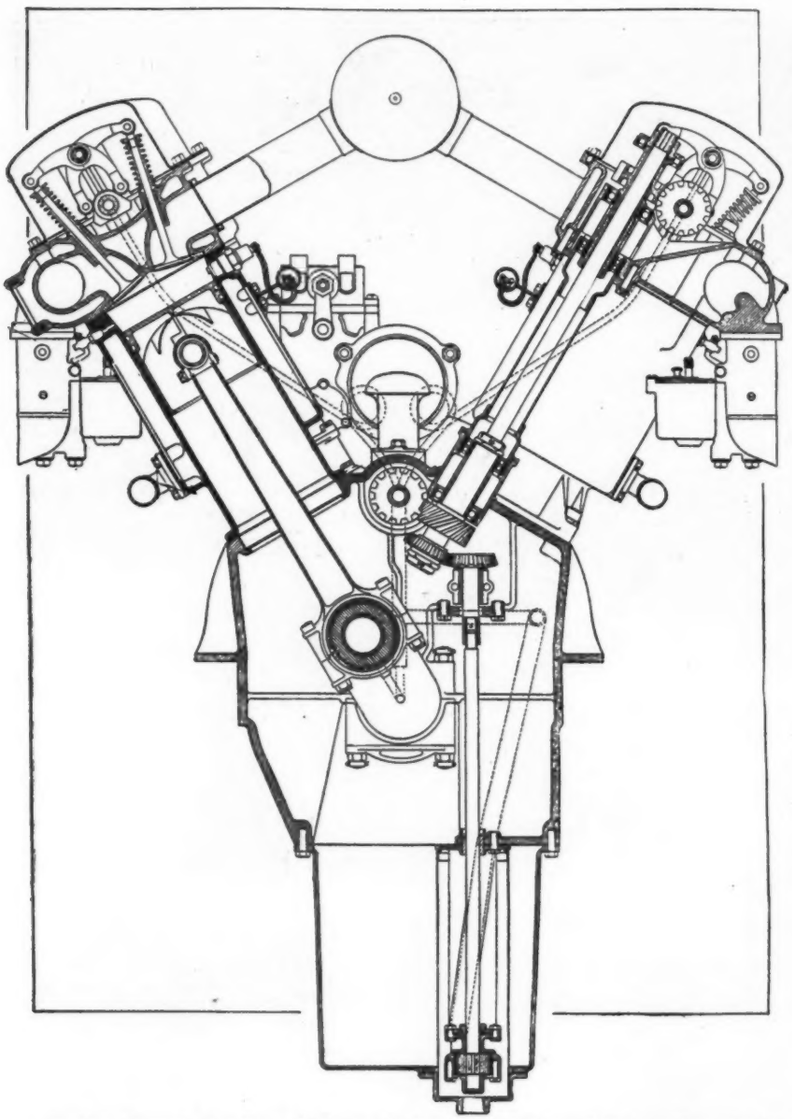
On one end of the engine is an





Above — Both sides of the Knox aviation engine, the upper one showing the arrangement of the ignition and water pump below. The lower picture shows the starting motor with its switch mounted immediately above a casing which contains the reduction gear for driving the propeller

Left—Looking along the V space between the cylinders showing the open exhausts, central location of the ignition unit and starting motor switch in front



Section through the Knox twelve-cylinder 4¾ by 7 in. aviation engine, showing the camshaft drive for the overhead valve rockers. The pump drive is also shown

aluminum housing for the timing gears and the support of the water pump, air pump, ignition apparatus and lighting generator.

On the other end of the motor is a heavy special aluminum casting to support the propeller shaft with its bearings in which the ball bearing holes are lined with steel bushing to prevent wearing the aluminum. This casting with its cover provides for the large starting gear on the propeller shaft as well as for supports for the starting motor, switch, etc.

Drive of Engine Accessories

The method of driving the different motor accessories is through a longitudinal drive shaft above the crankshaft and driven by the timing gears. This drive shaft has two integral spiral gears which are at the center of the motor for driving two vertical shafts, which extend up through tubes into the cylinder heads and on through short hollow shafts. Each vertical shaft terminates in a splined end with a splined cap piece which bolts to the short hollow shaft. This arrangement permits of changing the relationship of the camshaft to the vertical shaft for valve timing. The oil drainage from the cylinder head passes down through the ball bearings on the vertical shaft and thence through the tubes to the crankcase.

Motor lubrication embraces all of the moving parts of the engine. Oil flow originates in a pump supported from the upper half of the crankcase so that there is no pump connection between the pump and the motor. Steel pipes cast integrally with the crankcase register with the oil pump to make the necessary connections. Oil holes drilled in the case for lubrication are lined with steel tubes to insure against leakage. The main oil lead extends the entire length of the crankcase and has holes drilled to the crankshaft bearings, these also being steel lined.

The oil is taken in the crankshaft bearing at the timing gear and led to the horizontal driveshaft bearing immediately above it, and thence is led through the hollow driveshaft to the center or either end of the shaft, whence it flows through copper tubes to the cylinder heads. In each head it passes through the camshaft supporting brackets into the hollow camshaft, thence to all its bearings and to the hollow rocker arm shafts and to each rocker arm. The result of this oil circulation is that valve-stems, springs, rocker arms, rollers, camshafts and other moving parts are saturated at all times.

Timing gears are oiled by the throw-off of the crankshaft bearing at that end. The propeller gears are oiled in the same manner at the other end. Oil pressure is from 40 to 70 lb., there being an adjustable regulator on the side of the tank. A large oil screen is carried in the lower half of the crankcase and covers the oil pump clear up to the upper half of the case. This screen may be withdrawn for cleaning without disturbing any mechanism. On the outside of the crankcase is an oil gage.

Double Zenith carbureters are placed in each side of the engine, outside of the cylinder blocks, thus using a separate carbureter for each three cylinders. There is nothing on the outside of the engine excepting these carbureters; and there is nothing in the V between the blocks excepting the two breathers rising from the top of the crankcase.

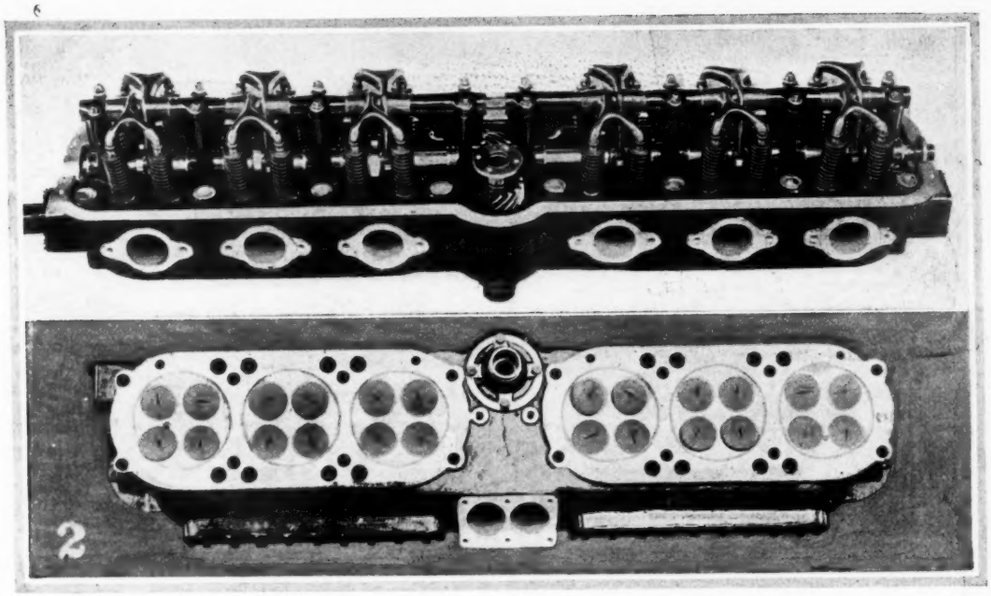
The electric starting motor and the lighting generator are built into the engine, the former so that starting is by pressing a button which throws the switch.

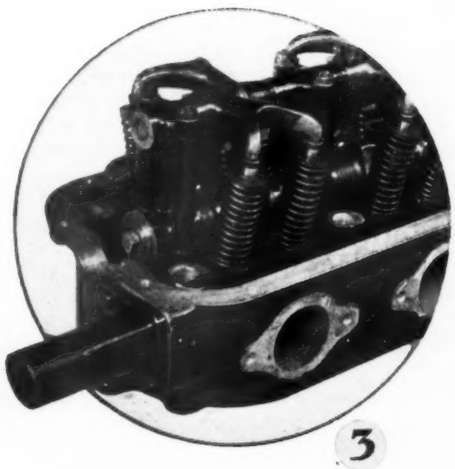
Ignition is by battery type with the current furnished by a battery for starting, but with the running current from the generator. There is one spark plug in each cylinder. All six priming cocks on each side of the motor can be operated at once by a pull-handle. Gasoline feed is by pressure furnished by a two-cycle type of air pump furnishing pressure of 4 to 7 lb. An adjustable regulator is attached.

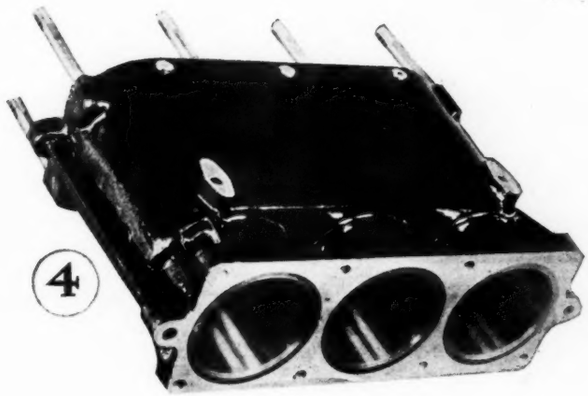
The water pump, a double impeller type, with water on each side of the impeller to avoid thrust, is made in one assembly and driven through a flexible coupling at the end of the crankshaft. The pump has one intake and two discharge pipes, which lead to brass taper tubes extending alongside of the engine on either side, and supplying the cylinder blocks with water at two points each. The water rises through the cylinder jackets, passing directly into the heads through registering holes and flows out at either end of the heads as desired.

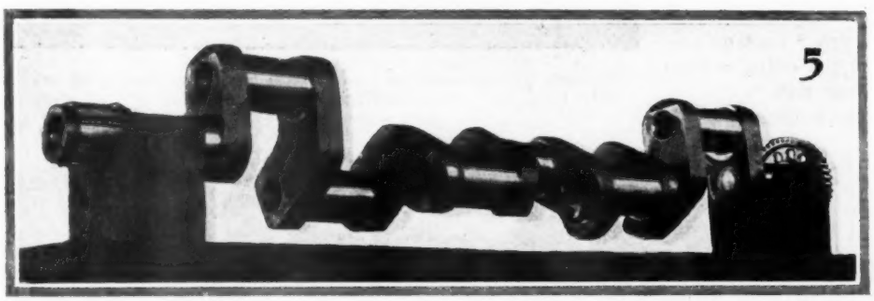
The propeller shaft is supported on a heavy double-row, self-aligning, ball bearing, with a thrust taken in either direction by a double ball thrust, with a load capacity of 2650 lb. in either direction. The propeller shaft is 3⅜ in.

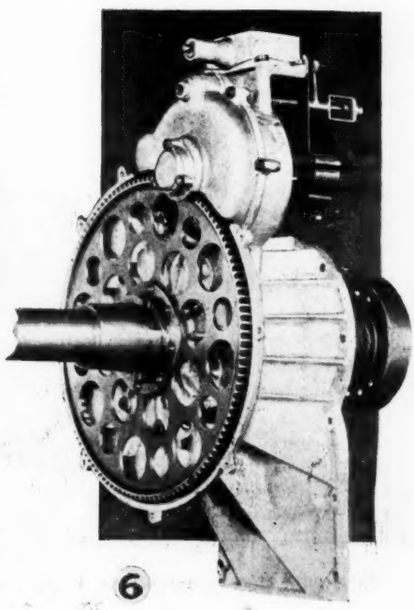
(*Continued on page* 862)











1—The aluminum alloy piston is provided with three rings and a series of small oil holes is drilled through it below the lowest ring groove. The connecting-rod is a drop forging

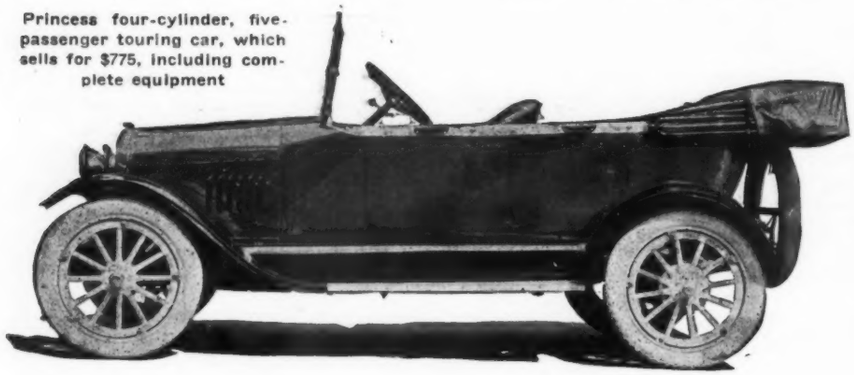
2—Two views of the cylinder head, which is of aluminum alloy cast in one piece with cast-iron valve seats. Note the four valves in each cylinder

3—Detail of the valve rockers which operate from a camshaft located immediately above the cylinder heads

4—The aluminum cylinders are cast in blocks of three and have cast-iron liners pressed in place

5—The crankshaft is a chrome-nickel forging 3 in. in diameter and has large bearing surfaces

6—Mounting of the starting motor, which has a single reduction gear to the crankshaft



Princess four-cylinder, five-passenger touring car, which sells for $775, including complete equipment

1917 Princess Is Larger

Wheelbase Increased 4 in.—Rear Axle Now Floating—Two-Unit Electric System

FOR 1917 the Princess Motor Car Corp. of Detroit is presenting a very much refined product as compared with the previous model. The factory is now pushing production and deliveries.

The car is larger, roomier and better equipped. The wheelbase has been increased from 104 to 108 in. the additional 4 in. being used for body space. This is the main factor in making the car larger and the difference is immediately apparent when last year's car and this year's are side by side.

Floating Rear Axle

In addition there have been numerous mechanical alterations. The rear axle design is entirely different, being floating instead of semi-floating. The starting and lighting system is a two-unit device instead of a single-unit one. It is Disco, as formerly. With the new installation a Bendix gear is used for the starting motor whereas the motor-generator outfiit previously used had a silent chain reduction of 3 to 1.

To take care of the larger car, bigger brakes are installed. they are 12 by 2¼ in., instead of 12 by 1¾. The tires are larger, being 32 by 3½ instead of 30 by 3½.

In the engine no changes of importance are made although there are perhaps a dozen alterations of minor consequence. The position of the magneto is new, and the oiling system changed in detail. This is a detachable head unit.

The speedometer drive is from the transmission gears.

Appearance has also been given attention in other details, particularly in the overhauling of the fenders and running boards. The running boards are now linoleum on wood, aluminum-bound, instead of aluminum on sheet metal. This is better construction right through, and besides being more sightly it is also stronger and does away with rattles. The front fenders are so formed that they are virtually sill boards also, this removes all the cracks and prevents the entrance of any dirt or water.

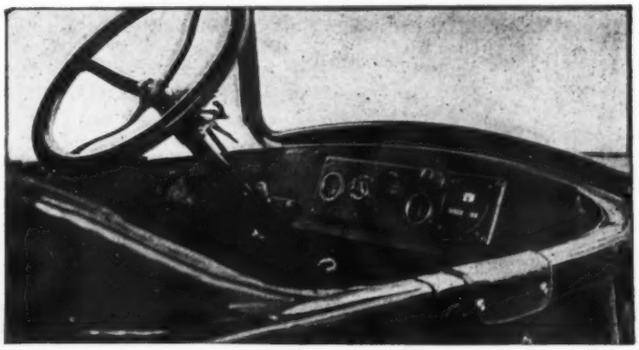
A sloping windshield instead of a vertical one makes not only for appearance but also for strength in taking the strains imposed by the one-person top. The side curtains are now easier to adjust.

On the instrument board the Van Sicklen speedometer, speedometer light, ammeter, oil gage, King lock, and fuse box with spring-attached cover, are grouped integrally. By taking out four screws the entire instrument assembly can be lifted out for repair or inspection.

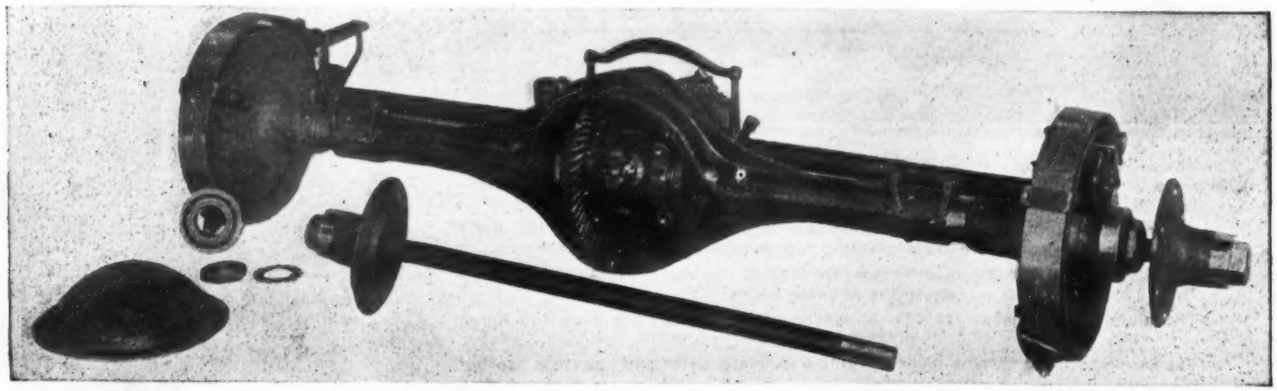
Unit Power Plant

The engine is a unit with the clutch and gearset, and is a four-cylinder, L-head block design with valves on the left. The cylinder dimensions are 3¾ by 4¼ in., giving a formula rating of 22.5 hp., and a piston displacement of 187.9 cu. in.

Conventional practice is followed in the engine design. It is a three-bearing crankshaft type. The valves are com-



Driver's compartment and new metal instrument board on the 1917 Princess. All wiring is integral. Board is of dull black enamel with instructions of nickel set flush



Floating rear axle design used in the 1917 Princess, supplanting a semi-floating construction in the previous model. Housing is of pressed steel and a four-pinion differential is used with six-spline side gears

posite, having cast-iron heads and nickel steel stems, and have an opening in the clear of 1⅝ in. and a lift of 7/37 in. The outside diameter is 1 13/16. They are adjustable by removing the side plates and turning a nut on the end of the push rod.

The silent chain drive for the timing gears and magneto runs in oil and has provision for adjustment. The lighting generator is also driven by silent chain.

Materials Standard

As far as materials are concerned, the engine is in line with usual practice, the connecting-rods being 0.30 to 0.36 carbon steel, drop forged and heat treated, the crankshafts are 0.35 to 0.40 carbon steel, and the cylinders and pistons of cast gray iron. The detachable cylinder head, is also of cast gray iron.

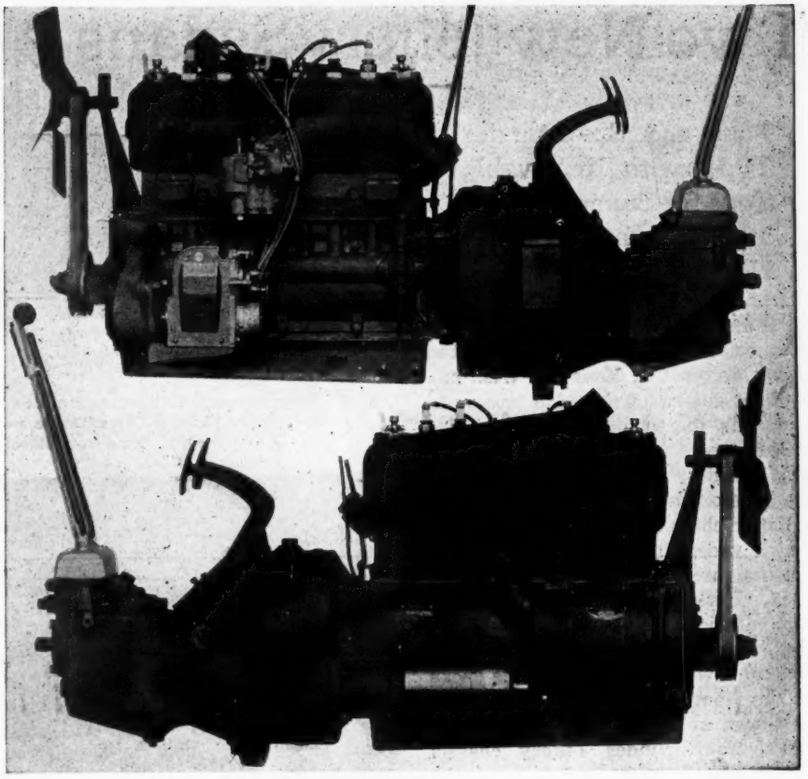
Oil is delivered by plunger pump driven from the No. 4 exhaust cam, to a dash sight feed and thence to the main bearings and thence to the splash troughs where the cylinders and other internal engine bearings are taken care of by the dip of the rods. The silent chain drive for the auxiliary devices is also cared for in this system by a separate lead which keeps the chain submerged in lubricant.

Ignition is by a Splitdorf Dixie type of magneto and carburetion by a Schebler.

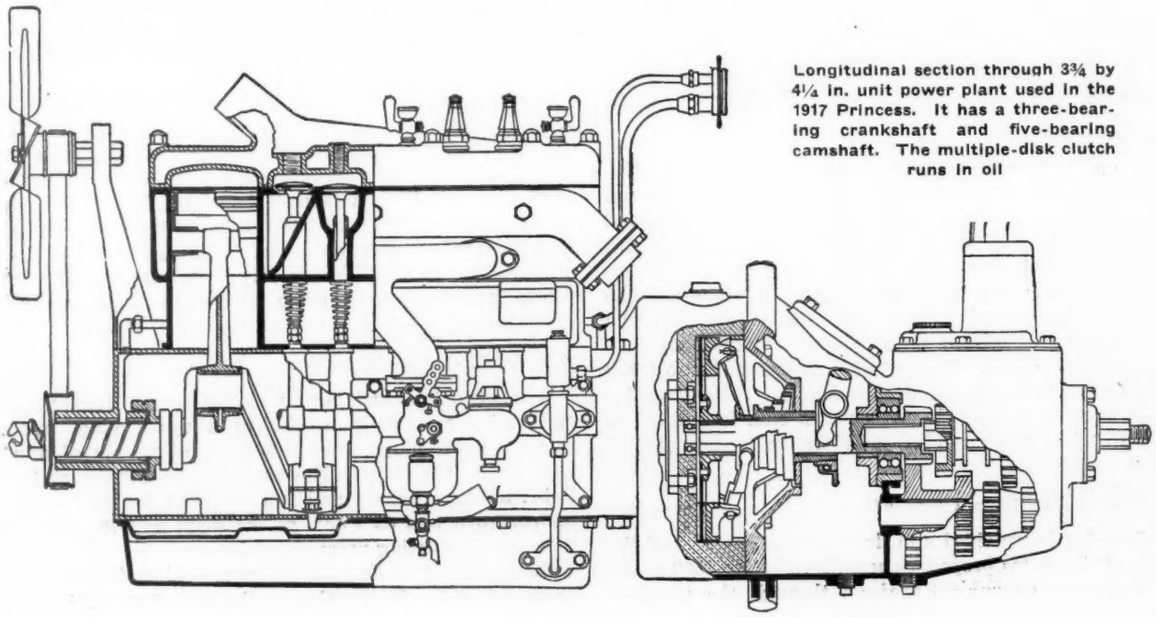
From the engine the drive is transmitted through a single steel dry-plate clutch to the Grant-Lees three-speed gearbox. The drive is the customary shaft with two universals. The rear axle is floating and the rear springs are three-quarter with the main leaf of vanadium steel. A guarantee against breakage of the main leaf is given for 2 years. The wheels are of hickory fitted in the rear with the 12-in. brake drums. The service brake is external contracting and emergency internal expanding on rear wheel drums, as shown in the view of the axle on page 860.

The new floating rear axle is amply strong, the housing being of pressed steel with a double lap on the differential housing; wall thickness is 5/32 in. A four-pinion differential is employed with six-spline side gears, gear ratio being 4 to 1, with twelve-tooth pinion and the gears are spirally cut. There is an independent adjustment on the bearings. Axle shafts are heat-treated chrome-nickel steel and 1¼ in. in diameter. Spokes are 1⅜ in. in diameter.

Fully equipped the car sells for $775, f.o.b. Detroit. The standard equipment includes electric starting and lighting, speedometer, Neverleak one-man top, two-piece, rain-vision windshield, two electric lights with dimmer, dash lamp, number bracket, robe rail, tire holder, extra rim, tool kit and electric horn.



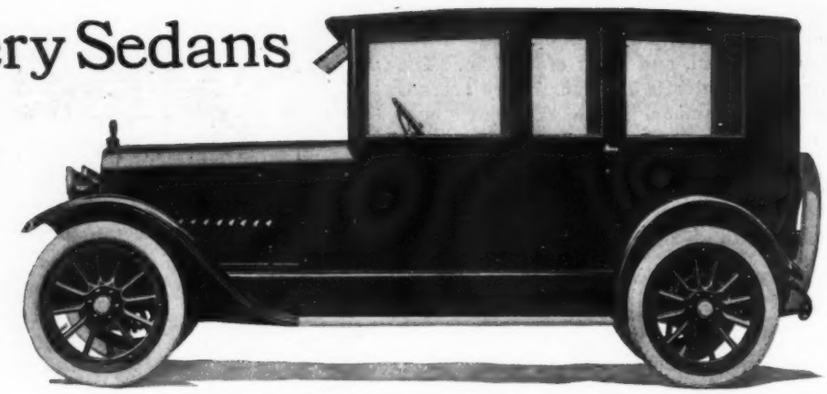
Both sides of the four-cylinder L-head unit power plant used in the 1917 Princess. The engine has a bore of 3¾ and a stroke of 4¼ in., giving a piston displacement of 187.9 cu. in. and a formula rating of 22.5 hp.



Longitudinal section through 3¾ by 4¼ in. unit power plant used in the 1917 Princess. It has a three-bearing crankshaft and five-bearing camshaft. The multiple-disk clutch runs in oil

Two New Jeffery Sedans

Four and Six-Cylinder Types with Removable Tops for Summer Touring Brought Out By Nash Motors Co.



New seven-passenger sedan body mounted on Jeffery six-cylinder chassis and selling for $1,530. The extreme simplicity and severe lines are characteristic of the design. Note how closely the fenders follow the wheel contours

AS announced recently in the news columns of THE AUTOMOBILE, the Nash Motors Co., Kenosha, Wis., has brought out two new sedan models to meet the increasing demand for inclosed cars for Winter service. The new bodies, however, which are mounted on both the four- and the six-cylinder chassis, have removable tops which widen the scope of their usefulness throughout all seasons of the year. Both models have seating accommodations for seven passengers, the two folding seats being neatly concealed when not in use in the backs of the front seats, which are divided, as shown at the right.

The four-cylinder Jeffery chassis has a wheelbase of 116 in. and the block engine is 3¾ by 5¼. A three-speed-and-reverse gearset is used in connection with a disk clutch and semi-floating axle. The six has a 125 in. wheelbase and the engine is 3½ by 4⅝. Rear axle is semi-floating.

Interior of the new Jeffery sedan body, showing the divided front seats, wide door and dome light in the ceiling

Both bodies are two-door constructions, a feature which enabled the designers to provide unusually wide doors, while the aisle between the front seats, which makes this arrangement possible is of ample width to permit the passage of the occupants of the front seats to the rear and *vice versa* without inconvenience. Like the doors, the windows, which are of the French plate type, are of noticeably liberal dimensions, the rear window being 31 in. wide and 19½ in. in height. These windows drop 5 in. to give adequate ventilation in warm weather, providing a good circulation of air without permitting a draft on the heads of the passengers.

Upholstery is of gray whipcord and roll curtains on the windows, with numerous other touches of luxurious refinement aid the work of the Nash engineers in giving the new sedans all the comforts of a standard high-priced limousine. To insure entirely weatherproof qualities in the top, in all conditions of wind, rain, snow or sleet, a series of painstaking experiments were made. As a final touch, the large dome light in the center of the top was provided for light and warmth.

Knox Aviation Twelve Tested

(*Continued from page* 858)

diameter bored out to leave ½-in. wall. On this shaft is located the starting gear which through a train of gears connects with a starting motor by roller clutch.

Propeller Hub Mounting

The propeller end of the shaft is tapered to take the propeller hub which it drives through four heavy integral jaws. The propeller hub is drawn onto this shaft by right-hand nut and locked by a left-hand plug. The propeller hub with its inside flange is in one piece, incorporating the jaws to engage the corresponding jaws on the propeller shaft. The propeller hub is splined on the outboard end to take the splined flange, thus giving an allowable thickness of propeller of from 5 to 9 in. The propeller is clamped into place by eight bolts passing through both flanges. The propeller shaft, as well as the crankshaft at this end, is splined to take the propeller gears. Spline construction is very general throughout the motor.

Tachometer Driven from Camshaft

A tachometer is provided and driven from one end of the camshaft. It indicates propeller speed from 500 to 1500 r.p.m.

The horizontal driveshaft projects through the gearcase cover, so that the pulley may be added to drive a wireless generator if necessary.

At a test of this motor made at the Knox factory Saturday, Nov. 11, a run of 8 hr. was made. During the first 7 hr. the engine speed was from 1400 to 1600 r.p.m., pulling a load of 200 to 245 hp. For the last, or eighth, hour the speed was 1600 r.p.m., pulling a load of 300 hp. The average horsepower for the 8 hr. was 243, giving a total of 1948 hp. hr. with a gasoline consumption of 198.4 gal. This is 0.612 lb. per hp. hr., which could scarcely be taken as a fair test, as you cannot expect to get a true test with one-quarter and one-half throttle conditions.

No Air Blown on Plugs

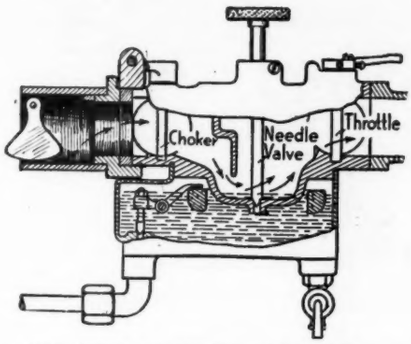
After the test had been under way for 40 min. a stop of 2 min. was made to change a spark plug, but after this no spark plugs were changed and no air of any kind blown upon the plugs. The water temperature was 108 deg. Fahr. at the entrance and 140 Fahr. at the discharge. Air temperature was 62 Fahr. at the start and 78 Fahr. at the finish, in the testing room.

The test was made with a Sprague electric dynamometer, as shown in the illustration at the top of page 856.

ACCESSORIES

Myle-Maker for Fords

THE Myle-Maker is an automatic auxiliary air adjustment for the standard Ford carbureter. A pendulum valve, actuated by the incoming air, hangs in a housing bolted to the air intake. It is secured by a set-screw, and may be fastened on by the owner in a very short time. When starting and at low speeds the valve restricts the air supply and causes a rich mixture to be sent to the engine; but at high speeds it is swung open, admitting more air. It is claimed that the device gives an easy starting mixture, as well as an economical mixture at normal speeds. Price, $5.—Myle-Maker Co., 323 East Twenty-third Street, Chicago.



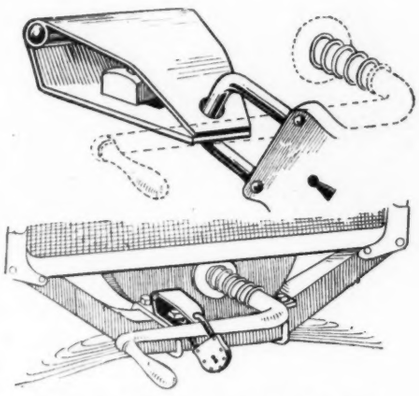
Myle-Maker air adjustment for Ford cars

Corning Conaphore

The Corning Conaphore is a device for preventing glare from headlights or spotlights. It is made either of yellow tinted glass, styled "Novoil," or of clear glass, having a smooth outer surface and a series of horizontal corrugations on the inner surface. These corrugations are said to bend the light rays down, until at no point are they more than 42 in. above the road. The yellow tinted glass is claimed to absorb the violet and blue rays, prevent glare, and transmit a ray that penetrates fog or dust. The sizes vary by ⅛ in. steps from 3 in. diameter to 11½ in. Price, Novoil, or yellow tinted glass, 3 to 4⅞ in., $1.30 per pair. Clear glass, 80 cents per pair. Other sizes in proportion.—E. A. Cassidy Co., 30 East Forty-second Street, New York.

Paramount Snubbers for Fords

These snubbers retard the upward motion of the body when recovering from a shock. One is installed on each end of the rear spring and consists of a resilient compression spring anchored in castings that are held in place by two cantilever springs. A strong webbing strap which buckles around the axle is fastened to the casting at the top of the compression spring. The lower casting is attached to the car spring by means of a tie-plate and two bolts. The installation only requires that the snubber be bolted to the rear spring, and the strap fastened around the axle, all of which may be done by the owner in a few minutes. Price, $6.—Detroit Engineering Products Co., Detroit, Mich.


Warner crank lock attached to Ford

Warner Lock for Fords

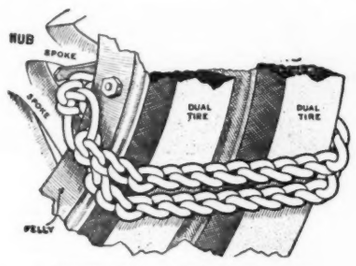
The crank of the Ford is locked in mesh with the crankshaft and the motor may not be turned over until the lock is released. A hinged metal member is bolted over the front spring clip and carries a heavy padlock that permits the crank to be held in mesh with the crankshaft. Price, $1.50.—G. H. Warner Co., 318 Century Building, Indianapolis, Ind.

Campbell Radiator Cover

The unlined covers are made of waterproof fleece-lined material with adjustable doors. The two-ply is imitation leather, waterproof, and the outside is lined with kersey blanket material quilted. Price, Ford unlined radiator cover, $1.38; Ford unlined engine cover, $1.14; Ford lined two-ply radiator cover, $1.58; Ford lined two-ply engine cover, $1.46. All other cars in proportion.—Perkins-Campbell Co., 622 Broadway, Cincinnati, Ohio.

Herman Truck Tire Chains

This device provides increased traction by means of three double cross-chains locked to each of the rear wheels. Each cross-chain is double, hence smaller than the equivalent single chain and said to reduce vibration. Price, per set of six double chains, 3 to 3½ in., $5; 4 to 4½ in., $6.50. Dual tires, 5 in., $13; 6 in., $15; 7 in., $17.—Herman Mfg. Co., 1420 Pennsylvania Avenue, Washington, D. C.

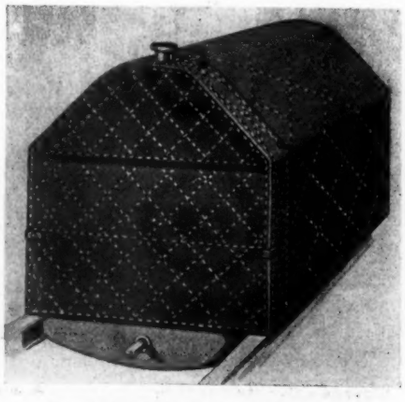


Herman tire chain for trucks

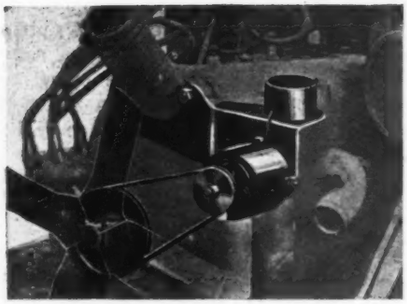
Allen Gloves

These are heavy, warm gloves for automobiling in winter. Over a detachable

Corning Conaphore glare preventer


Campbell radiator and hood cover

Paramount snubber for Ford cars



Genolite lighting system installed on a Ford engine

woolen glove is the leather glove proper, that may be worn separately if desired. These gloves are made in mitten, one-finger and glove shapes, finished either in black or tan leather. One of the many styles the company makes is illustrated herewith. They sell for $5 per pair.—Allen Glove Co., Gloversville, N. Y.

Stevens Valve Stem Reamer

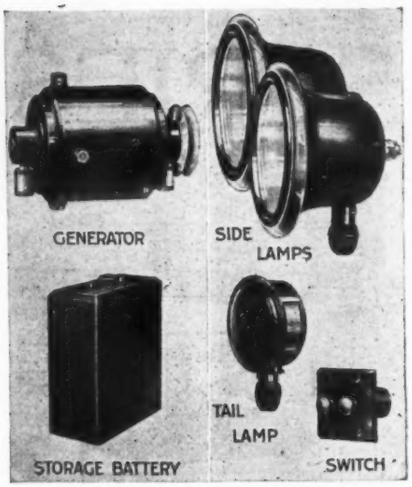
By the use of the valve stem reamer guide and the special reamer, the worn valve guides of the Ford motor may be reamed 1/64 in. and fitted with the special valves having an oversized stem. The reamer guide is held in the valve seat by means of a clamp bolted in an adjacent cylinder-head bolt hole, holding the reamer in alignment and insuring an accurate job. The special valves supplied are of good quality, having the head electrically welded to the stem, which is 1/64 in. oversize. Price, valve stem reamer, $1.50; valve stem reamer guide, $1.50; oversize valves, 20 cents each.—Stevens & Co., 375 Broadway, New York.

Amazon Tire

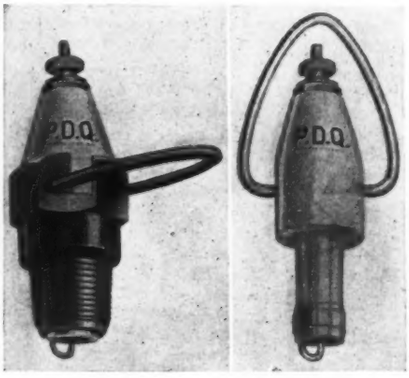
The Amazon is a reinforced non-skid tire, as shown in the illustration. Just below the outer edges of the tread heavy breaker strips are placed above the fabric body. It is claimed that these strips absorb the shocks and strains that otherwise would be transmitted direct to the tire carcass, and thus increase the life of the tire. Price, 30 by 3½, $14.75; 32 by 3½, $17; 34 by 4, $24.50, and 36 by 4½, $35.50.—Amazon Tire & Rubber Co., Akron, Ohio.

Genolite Lighting System

This lighting system for Ford cars includes a 2-volt generator, a single-cell storage battery, two side lights, a tail light and a switch, together with all brackets and wiring necessary to make the installation. The generator is mounted on a bracket secured by the two hose-coupling bolts to the forward end of the motor. The cut-out mounted on this bracket automatically connects and disconnects the generator and the battery at the varying engine speeds. The generator is driven by a spiral wire belt from a split pulley attached to the fan.

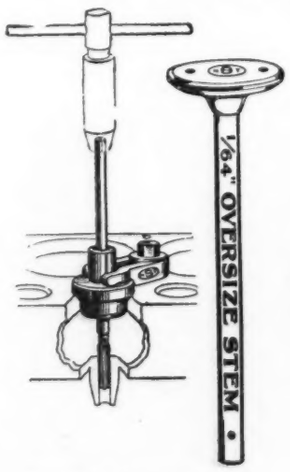


Genolite lighting system complete outfit



P. D. Q. spark plug which operates on the bayonet lock principle to simplify cleaning and priming

Allen gloves are made in several styles. This has a detachable inner glove



Stevens valve stem reamer for Fords

The wiring is of the grounded system, the wires being of various colors and properly labeled to eliminate wrong connections. The battery is of 40-amp.-hr. capacity and guaranteed for 15 months. The generator will generate from 8 to 10 watts, and is said to be more than ample to take care of the complete lamp load. No machine work is required in the installation, and it is claimed that the work may be done in 2 hr. Price, $19.85, f.o.b. Detroit.—Detroit Starter Co., Detroit, Mich.

P. D. Q. Spark Plug

The P. D. Q. is a two-pieced plug having a detachable porcelain. The union between the porcelain and the shell is made tight by accurately machining the joint, and is held by means of a bayonet catch. The construction is claimed to be durable, to permit easy inspection and cleaning, and to offer a ready means of priming. The plug is made either with the ½-in. standard S. A. E. or metric thread. Price, $1; extra porcelain, 75 cents.—Wolverine Spark Plug Co., Detroit.

Universal Master Wrench

A new principle is employed in this wrench, which may be used for turning square or hexagonal nuts, or for pipe. It has a non-adjustable V-shaped jaw, one side of which has fine, sharp teeth and the other is provided with a transverse V-block which slides on this member of the jaw. This block is so shaped that it will receive a square nut, a hexagonal nut or a pipe or rod and as soon as pressure is applied to the handle, will jam the work firmly against the other jaw. Quick adjustment is provided because it is only necessary to move the V-block along the jaw and there is nothing to hinder this motion.—Shepard-Prince Co., 18 East Forty-first St., New York City.

A section of the Amazon reinforced non-skid tire, showing strong inner structure

Industrial Miscellany

Factory

Goodyear Tire & Rubber Co., Akron, Ohio, has leased 10,000 acres of cotton land near Chandler, Tex., and has engaged E. W. Hudson, formerly government cotton expert, to take charge of the plantation. The company will engage in the raising of long staple Egyptian cotton for the manufacture of automobile tires, it is stated.

Shortage of skilled labor grows more acute each day, and the condition is general throughout Wisconsin. The motor car and truck industry is feeling the result. The Four Wheel Drive Auto Co., Clintonville, Wis., is advertising heavily in Milwaukee and Chicago newspapers for fifty turret and engine lathe, milling machine and drill press operators; ten bench hands; ten assemblers, and two inspectors, but has been able to get only a very small number of men. From 800 to 1200 skilled machinists would be given immediate employment if they were available.

At the present rate of rubber plant growth and activity in Akron it looks as if 15,000 more men would be needed in that city by March of the coming year.

The Firestone Tire & Rubber Co. is now employing 7000 men as against 3500 last year. This company now has four new buildings under construction, Goodyear has eleven, Goodrich five, and Miller two.

The Miller company used to employ 500 men. It now has 1750 on its payroll. The Goodrich factory, biggest of all, now has 14,000 employees and is unable to obtain the 2000 additional which are needed.

Production at the plant of the Westcott Motor Car Co., Springfield, Ohio, has increased about two and one-half times that of a year ago and a further increase is expected within the next half year. The present output is twenty-five cars a day.

Last July the factory was removed from Richmond, Ind., to its present location. The company was organized in Richmond in 1869 and became prominent as a manufacturer of horse-drawn vehicles. The increased demand for its automobile necessitated the removal to larger quarters, which are used entirely for the manufacture of the car.

The new plant consists of a three-story building, consisting of 176,000 sq. ft. of manufacturing space.

Macon Motor Car Sales Co., St. Louis, will be organized at once to sell The Macon, a car assembled at the factory of The All Steel Automobile Co., Macon, Mo. Salesrooms at 2206 Locust Street have been leased.

"Efficient Methods in Making Brake Lining Renewals" is the title of a folder recently issued by General Asbestos & Rubber Co., Charleston, S. C., manufacturer of the Garco brand of brake lining. This folder is written in plain, understandable style, and is designed to enable the inexperienced motorist to reline his brakes with perfect success.

Anger Engineering Co., 301-305 Sixteenth Street, Milwaukee, which manufactures the A. E. C. custom-built cars and operates a large service shop, has completed arrangements for the establishment of a large new plant at Twenty-sixth and State Streets, Milwaukee. The building will be of fireproof construction, 130 by 120 ft., one-story and basement, and contain the machine shop, factory, service shop and a public garage, together with offices and salesroom for the Ford agency recently acquired by the Anger company, and now conducted in separate quarters at 1517-1519 State Street.

Monarch Tractor Co., Chicago, has taken over the John Dornfeld Iron Works, Watertown, Wis., which in recent months have been devoted to the manufacture of farm tractors and sugar cane harvesting machinery. The Monarch company, a South Dakota corporation, is capitalized at $250,000 and now has more than $400,000 worth of orders booked. The tractor is styled the Never-Slip and is built in sizes from 6 to 50 hp. The 45-hp. type is used as the motive power of the Luce sugar cane harvester, an 11-ton machine which does the work of forty to sixty men on sugar plantations.

Maxwell Motor Co. at Kansas City, Mo., has already started work on the new assembling plant there, which will be ready for occupancy about the first of the year and which will cost $300,000. Bids are in for the erection of a large assembly plant at Windsor, Canada, where the Maxwell company plans to erect a building 100 by 300 ft., four stories high. It is planned to establish a chain of assembly plants throughout the country, and a site has already been secured at Minneapolis.

The Automobile Calendar

ASSOCIATIONS

Nov. 22—Boston, Mass., National Assn. of Automobile and Accessory Jobbers' Meeting.

Dec. 2-9—Electricians' Countrywide Celebration.

Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.

Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore. Special performance Ziegfeld's Midnight Follies.

Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.

Nov. 16—New York City, S. A. E. Meeting.

Nov. 23—Philadelphia, Pa., S. A. E. Meeting.

Dec. 7—Baltimore, Md., Safety First Convention of Safety First Federation of America.

CONTESTS

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race. Arizona State Fair.

Nov. 24 and 25—Newark, N. J., 24-Hr. Endurance Run of N. J. Automobile and Motor Club.

Nov. 30—Uniontown, Pa., Speedway Race.

Nov. 30—Los Angeles, Cal., Ascot Speedway 200-mile Championship Race.

1917

April—Los Angeles to Salt Lake City Road Race.

May 19—New York Metropolitan Race on Sheepshead Bay Speedway.

May 30—Indianapolis Speedway Race, Championship.

June 9—Chicago, Ill., Speedway Race, Championship.

June 23—Cincinnati, Ohio, Speedway Race.

July 4—Omaha, Neb., Speedway Race, Championship.

July 14—Des Moines, Iowa, Speedway Race, Championship.

July 28—Tacoma, Wash., Speedway Race, Championship.

Aug. 4—Kansas City Speedway Race.

Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.

Sept. 15—Providence, R. I., Speedway Race, Championship.

Sept. 29—New York, Speedway Race, Championship.

Oct. 6—Kansas City Speedway Race.

Oct. 13—Chicago Speedway Race.

Oct. 27—New York Speedway Race.

SHOWS

Nov. 10-18—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.

Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers' Assn.

Dec. 2-9—Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.

Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel I. R. Gates, Mgr.

Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 2-10—New York, Automobile Salon, Hotel Astor, J. R. Eustis, Mgr.

Jan. 6-13—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 9-10—Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.

Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.

Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.

Jan. 23-27—Baltimore, Md., Show, Fifth Regiment Armory.

Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.

Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.

Feb. 19-24—Duluth, Minn., Show, Duluth Auto Dealers' Assn., Armory.

Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 1, 2, 3—Urbana, Ill., Show, Automobile Trade Assn. of Champaign Co., Armory of the University of Ill.

March 6-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

March 14-17—Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade.

Personal

Charles Drum has been made the superintendent of production for the Springfield Body Co. Mr. Drum was formerly connected with the Haynes Mfg. Co.

The Springfield Body Co. will move to its new plant at Springwells, near Detroit, by Feb. 15 and will have a capacity of 100 bodies per day. At present the company has a capacity for thirty-five bodies daily.

Calvin Dunlap has become the vice-president of the International Commercial Corp. of New York. Mr. Dunlap was formerly the export manager for the Hupp Motor Car Co.

J. E. Turk, formerly connected with the Thomas B. Jeffery Co., Kenosha, Wis., has been appointed sales representative of the Chalmers Motor Corp. in Central West territory.

C. F. Barth has been appointed works manager for the C. F. Wilson Body Co. Mr. Barth was formerly the factory and production manager for the Murphy Chair Co.

A. E. Gluck, purchasing agent for the Packard Motor Car Co., New York City, has resigned. He has become president and general manager of the Abbott Motor Equipment Co., this city, distributor for the Warner lens, Block mirrorscopes, Amsco jacks and Twombly foot pumps. S. S. Frankenstyne remains as treasurer and sales manager. H. T. Stevenson succeeds Mr. Gluck as Packard purchasing agent, while W. C. Lyons takes up his work as head of the accessory department.

A. S. Gilchrist has been appointed manager of the Maxwell Motor Sales Corp., Baltimore, Md. He succeeds L. A. Tilley, who resigned. E. A. McKee, of the efficiency sales promotion department of the Maxwell company, has been attached to the local office indefinitely. Mr. Gilchrist is a former newspaper man, but has been with the Maxwell company for more than three years. He has been attached to the sales department and was also southwestern manager with headquarters at Houston, Tex.

J. R. Blocher, formerly branch manager of the Prest-O-Lite Co., in Baltimore has been appointed division manager and will make his headquarters here. E. W. Carpenter, who has been with the company for a long time becomes branch manager in Baltimore.

J. A. Muir, who was with the D. E. Truck Co. in Baltimore and for a number of years with the Mar-Del-Mobile Co., Packard and Saxon agents, has been appointed sales manager of the Monumental Motor Car Co., Kisselkar representative.

A. E. Hertzig, manager of the Baltimore branch of the Goodyear Tire & Rubber Co., Akron, O., has been appointed manager of the Washington branch of the company and will take care of the territory in both sections. L. J. Gemmil, who was manager of the Washington branch will look after all of the government business exclusively.

E. T. Cole, manager of the Akron Tire & Rubber Co., Baltimore, Md., Ajax distributor, has taken the state agency for the Cleveland Standard Tire & Rubber Co. Charles E. Brooks will be in charge of the wholesale business throughout the state.

Harry Lowenstein has become manager of the R. M. Stein Co., Baltimore, Md. F. M. Sandy has become sales manager, and Charles Foutz, factory superintendent. The company operates two separate lines and handles the Moon and Ford.

A. E. Dixon has been made a member of the advertising department of the Chalmers Motor Co., Detroit. Before joining the staff of the Chalmers he was connected with the advertising departments of the Hupp Motor Car Corp. and the Packard Motor Car Co. Mr. Dixon will edit Chalmers Shop and Service, and will prepare pamphlets and other literature. The Chalmers Illustrated News has recently made its appearance.

A. H. Bailey has entered the Chemi Co., Richmond, Va., and has been elected vice-president.

M. A. Steele, late manager of the Henney Buggy and Stephens Motor branches of the Moline Plow Co., at Freeport, Ill., has been appointed general sales manager of the Stephens Motor branch with headquarters at Moline, Ill., H. J. Leonard, who has been assistant manager, succeeds Steele at Freeport.

F. C. Herschbach, of St. Louis, has resigned as assistant sales-manager for the Commercial Auto Body Co. of that city, for a similar position with the R. Haas Electric & Mfg. Co., Springfield, Ill.

G. O. Smalley has been elected first vice-president and general manager of the Bound Brook Oilless Bearing Co., Bound Brook, N. J. He succeeds the late Leigh Stanley Bache.

F. H. Whitman, formerly of Dodge Brothers, Detroit, has been appointed production engineer of the National Motor Vehicle Co., Indianapolis.

H. H. Brooks has been appointed superintendent of agencies at the Madison plant, Anderson, Ind. Brooks was one of the original incorporators of the Marathon Motor Works, Nashville, Tenn., where he served several years as sales and advertising manager. He was later connected with the Wayne Works, Richmond, Ind., and still later with R. A. Palmer in the Pontiac Chassis Co., Pontiac, Mich., in the same capacity.

Alvan T. Fuller, who handles the Packard line in Eastern New England from Portland, Me., to Providence, R. I., has been elected to Congress from Massachusetts. He entered the fight at the last minute as an independent against Congressman Ernest Roberts.

Dealer

Studebaker line has been dropped by the Corson-Berry Co., Springfield, Mass., and the Paige taken on its place. The Becker-Stutz Co., has taken on the Studebaker and moved to new salesrooms. W. F. Cassidy, who has the Grant Six, has moved into new quarters. The Western Massachusetts Longford Co. has shifted to 453 Worthington Street. The Harrington-Gifford Co. handling the Hudson Six, has also moved.

National Sales Co. has been organized at Providence, R. I., to handle the National line for Rhode Island.

Studebaker Corp., Worcester, Mass., has moved to temporary quarters on Main Street until its new building is finished.

Auto Trading Co., Pittsburgh, Pa., has taken over the Metz interests in that part of the State.

The Chevrolet Motor Co., of New York, has just opened a branch in Worcester, Mass.

The Springfield Body Co. has opened a branch at New York City in the Locomobile building, 16 West 61st Street, and has sent Charles Baasch on from the factory to take personal charge of it.

W. L. Patterson, St. Louis, has added Whitemore's automobile grease to the line handled by him at 3218 Locust Street.

Newsome Valve Co., St. Louis, has been organized to manufacture a tire tube invented by J. M. Newsome.

Auto-Devices Co., St. Louis, has taken the agency for the Hi-Comp piston ring. Salesrooms are at 3212-14 Locust Street.

Geller, Ward & Hasner Hardware Co., St. Louis, is territorial distributor of Prismolite lens.

Auto Sales Co., St. Louis, has removed into larger quarters at 908-10 Chestnut Street and becomes agent for the Wesco garage heating systems.

J. T. Conaghan has opened a garage and sales agency in Pekin, Ill., and will handle the Ford car, succeeding the Pinkerton Co., which retires from the Pekin field.

Bosch Magneto Co. has appointed the following new service stations: A. L. Ebbeson, Bangor, Me.; Auto Service Co., Bridgeport; Connel Wilson Electric Co., Jacksonville, Fla.; Harrington Motor Co., Mobile, Ala.; Garlock & Haynes, New London, Connel Auto Ignition Co., San Jose, Cal.; Essanell Electric Co., St. Paul; Tonopah Electric & Tire Co., Tonopah, Nev.; Tri-State Garage Co., Uniontown, Pa.; Tourist Garage & Motor Repair Co., Wilmington, Del.

Willys-Overland, Inc., selling organization has opened a direct branch at 33 Allyn Street Hartford, Conn., and succeeds in business The Overland-Hartford Co., at the corner of Allyn and High Streets. E. C. Bowman is manager of the new branch and associated with him is F. C. Brown, also a factory man. I. F. Maxson, manager of the Overland Hartford Co. will represent the Toledo factory in another capacity.

G. H. Grabb, Haynes and Auburn distributor, Hartford, Conn., has removed his salesroom to 289 High Street.

Keeney Truck Sales Co., 120 Allyn Street, Hartford, Conn., has taken over a portion of the Mattison building at the corner of Albany and Center Streets, and will use it as a service department for Selden and Vim commercial vehicles.

Adams-Bagnall Electric Co., Cleveland, Ohio, is now completing an addition to its factory with the installation of a complete vitreous or porcelain enameling plant.

Norton Monsarrat and Captain I. I. Morrison have organized the Stewart Motor Sales Co. for the purpose of handling Stewart trucks in central Ohio territory. They have opened sales room and a service station at 103 North Front Street, Columbus.